

**A Socioeconomic Analysis  
of the Impact of the Proposed Piñon Ridge Uranium Project on  
Western Mesa, Montrose, and San Miguel Counties, Colorado**

Prepared for

**Sheep Mountain Alliance**

By

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# Executive Summary

## Introduction

Since the American uranium industry went bust in the early- to mid-1980s, no company has built a new uranium mill in the United States. Now, Energy Fuels Resources Corp., a subsidiary of Energy Fuels Inc., has requested a permit from the State of Colorado to construct the Pinon Ridge Mill about seven miles west of Bedrock, Colo., in western Montrose County. If built, the proposed project will pulverize and process about 500 tons of uranium ore each day to produce fuel for nuclear reactors, leaving behind hundreds of tons of radioactive waste each day.

This report is based on comprehensive socioeconomic modeling of the potential economic impacts – negative and positive – that the proposed mill and associated mines would have on rural economies in western Montrose, San Miguel, and Mesa Counties. Previous analyses commissioned by Energy Fuels and Montrose County failed to consider potentially significant economic costs and the boom and bust nature of the uranium industry.

Other key findings from the report include:

**FINDING 1:** *Energy Fuels and Montrose County’s analyses overestimate the number jobs likely to be generated by the mill*

Energy Fuels projects that the mill would create 315 well-paying jobs. The analysis commissioned by Montrose County estimates that 516 to 649 new jobs would be created directly or indirectly by the mill and mines.

However, this report found that the mill would likely generate about 116 jobs in the West End of Montrose County – or between 35 percent and 80 percent fewer jobs than predicted by the mining company and the county

**FINDING 2:** *The positive economic impact from the proposed mill will likely be short-term and relatively small.*

This report found that the total impact on employment in western Montrose County including multiplier impacts, will be 116 jobs – far below the hundreds of jobs Energy Fuels and Montrose County officials have suggested. The projected impact is small for several reasons:

- Western Montrose County does not have the commercial infrastructure to hold and circulate the spending associated with the mill and that much of it could leak to bigger cities like Grand Junction.

- Little, if any uranium mining to supply the mill will initially take place in Montrose County – making it unlikely that mining and hauling jobs will be filled by Montrose County residents.
- It is highly unlikely that most or all of the 85 mill jobs will go to currently unemployed workers or currently out-commuting workers who live in western Montrose County. The pool of qualified workers applying for the jobs will be much broader than that.
- Workers may choose to live at some distance from the mill and mines to protect the investments they put into their homes. Some businesses serving the mill and mines and their workers may choose to do the same.

**FINDING 3** *Uranium milling and mining will likely have significant, long-term negative effects on the local economy.*

Studies commission by Energy Fuels and Montrose County fail to consider the mill's negative impact on the local economy. The mill will generate huge volumes of radioactive waste that will remain on site permanently. That radioactivity is the source of significant human health concerns that can lead to negative local economic impacts, including discouraging new residents and businesses to locate in the area.

**FINDING 4:** *Energy Fuels socioeconomic analysis fails to acknowledge economic instability that comes from uranium mining – a legacy marked by several periods of booms and busts.*

Despite the past unstable pattern associated with uranium milling and mining in southwestern Colorado, Energy Fuels assumes that its proposed mill and associated mines will operate uninterrupted for 40 to 50 years. There is no uranium mine or mill in the United States that has operated with such sustained stability. Economic projections based on such faulty assumptions are misleading and cannot lay the basis for reasonable socioeconomic analysis.

**FINDING 5:** *Local economies expanded as mining and milling declined in the 1980s – with the surge attributable to the growth of a visitor economy, the attraction of retirees and their investment income, and the in-migration of new residents and businesses.*

Montrose, Mesa and San Miguel counties experienced significant economic expansion after the collapse of the uranium industry in the mid-1980s. These three counties added over 66,000 jobs, gained almost 73,000 new residents primarily through in-migration, and saw aggregate real income increase by two and a half fold.

Many of these new sources of economic vitality were associated with the attractiveness of this region as a place to live, work, do business, and raise a family as well as a place to visit or live part-time.

**FINDING 6:** *At least as many jobs could be generated by cleaning up contaminated, abandoned uranium mines than could come from the new mill*

Economic modeling indicates that this activity could provide at least as many jobs and associated payroll as the proposed mill. Clean up of abandoned mines could also help increase economic growth by protecting the region's quality of life, which has attracted thousands of new businesses and residents in the last several decades.

Ultimately, because Energy Fuels uses its socioeconomic analysis primarily as a public relations and marketing tool for its proposed mill, that socioeconomic analysis does not provide the realistic and pragmatic view of both the costs and benefits that is necessary for rational public decision-making.

The critical question is whether the relatively small size of the expected new local jobs, income, and net fiscal benefits justify the downside costs and risks associated with this new mill. Those risks include additional radioactive waste and pollution problems and the impact of that environmental damage on the dominant sources of economic vitality in the region: local natural and social amenities and quality of life that have supported in-migration of new residents and businesses as well as the visitor economy.

The past and expected future instability of the uranium industry and its expected impact on the reliability and duration of the small positive economic impacts also has to be considered.

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## 1. Introduction and Conclusions

Energy Fuels Resources Corporation (Energy Fuels) has proposed to build a uranium mill in the Paradox Valley in the west end of Montrose County (West End) in western Colorado. The uranium ore for this proposed mill would come from Energy Fuels' mines on the Utah border in Mesa County, a mine in the La Sal area of southeastern Utah, and from many other mines in western Colorado and eastern Utah over the stated life of the project. Because Energy Fuels seeks permits for its Piñon Ridge mill from the State of Colorado, this study will primarily focus on the expected socioeconomic impacts on a three-county study area in Colorado including Montrose, Mesa, and San Miguel Counties with special emphasis on Montrose County's West End where the mill would be located.

Energy Fuels has characterized the socioeconomic impacts of its Piñon Ridge project entirely in positive terms. The proposed uranium mill and associated mines have been presented as a significant boost to local economic development in the surrounding rural areas. Energy Fuels projects that the mill will directly and indirectly create 315 new jobs that pay unusually high wages. The average annual labor income per job will be almost \$60,000.<sup>1</sup> The socioeconomic impact analysis commissioned by Montrose County was even more expansive in its job projections, estimating that 516 to 649 new jobs would be created directly or indirectly by the mill and mines.<sup>2</sup> The expenditures of the mines and mills as well as the spending of their high-paid workers were projected to circulate in the local economy causing ripple or multiplier impacts that create positive impacts far beyond the direct employment and payroll of the proposed mill. This will, it is suggested, lay the basis for a significant economic expansion in the area, potentially stimulating ongoing economic development in this rural area.

As this report will document, that is a seriously incomplete story that exaggerates the positive economic impacts that the Piñon Ridge project will have on the rural west ends of Montrose, Mesa, and San Miguel Counties while ignoring the negative economic impacts. In addition, the Energy Fuels and Montrose County socioeconomic analyses mischaracterize these counties' economies and the primary sources of their economic vitality. This report will show that the expected positive impacts of the mill and associated mines will be relatively small, with multiplier effects 116 total jobs, *not* 300 to 650 jobs, while the economic risks are substantial.

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<sup>1</sup> See Energy Fuels' "Socioeconomics Baseline and Impact Analysis for the Proposed Piñon Ridge Uranium Mill Montrose County, Colorado, The Louis Berger Group, November 5, 2009, Table 27, page 46.

<sup>2</sup> "Montrose County Socioeconomic Impact Study," Economic & Planning Systems, Mike Retzlaff, and Lloyd Levy Consulting, (EPS #19841), March 31, 2010, Table 14, p. 35.

## ***The Actual Experience of Western Colorado with Uranium Milling and Mining***

There is no need to guess or speculate as to the likely impact of a revival of uranium milling and mining on the economies and communities of the west ends of Montrose, Mesa, and San Miguel Counties. These rural areas have lived with the uranium industry for a century, experiencing the instability in employment and income and environmental degradation and health risks typical of areas dependent on mining.

The uranium booms and busts in the region had a major, destabilizing, impact on the rural areas and small communities in the west ends of the three counties. The West End of Montrose County, for instance, lost almost 60 percent of its population between 1960 and 1990. One of the mill towns in Montrose County, Uravan, and its surrounding area had 600 residents in 1950 and ceased to exist altogether by 1986. The west end of San Miguel County went from less than 200 residents to over 1,000, and then collapsed to about 100 residents between 1930 and 1990. For the three-county study area estimated real mining payroll went from \$82 million at its peak in 1979 to \$7 million in 2000, over a 90 percent loss. By the end of the 20<sup>th</sup> century, the Gateway area in Mesa County and the Slick Rock area of San Miguel County showed no remnants of mining-related economic development. The same was true of most of the West End of Montrose County.

This instability in uranium prices, production, and employment is not just a matter of the distant past. The recent fly up in uranium prices between 2004 and 2007 stimulated uranium mining and milling, the development of new mines, and the proposal for the Piñon Ridge mill. The precipitous decline in uranium prices between 2007 and 2009 led to the closing of mines, the failure to open the new mines, and the closing of Colorado's only operating uranium mill and the associated loss of jobs and income.

As Colorado and the Mountain West know, this is not an unusual story for mining dependent communities. In fact, this is a familiar pattern in metal mining. High commodity prices bring new mines and additional mineral production on line around the globe. The resulting increase in supply then puts downward pressure on metal prices, undermining the viability of the higher cost mining and milling operations that are then forced to shut down. That reduction in supply helps the economy absorb the excess production and prices stabilize. As the world economy expands, demand for metals grows and metal prices begin to rise, again stimulating actions that expand supply, and again putting downward pressure on prices and production. This cycle tends to be regularly repeated, as the Uravan Mineral Belt knows all too well.

This endemic instability in uranium and other mineral commodity markets discourages economic development by discouraging private and public investment. Given that no one knows how long a mining expansion and the income it generates will last, workers, local businesses and local governments act in ways that will protect their investments in the face of uncertainty. Mill and mine employees may live at some distance from the mill and mines so that the value of their homes will not be threatened by a shutdown. Local businesses will be hesitant to expand when spending expands because they do not



know how long the higher spending will last. Local schools and governments are hesitant to borrow money to make investments in local infrastructure because they know their future revenue streams are uncertain. The net result is depressed local economic development despite the high wages paid and the wealth extracted from the earth.

Despite this past unstable pattern associated with uranium milling and mining in the Uravan Mineral Belt area, Energy Fuels projects its economic impacts by assuming that its proposed mill and associated mines will operate uninterrupted for 40 to 50 years. There is no uranium mine or mill in the United States that has operated with such sustained stability. Economic projections based on such counter-factual assumptions are misleading and cannot lay the basis for reasonable socioeconomic analysis.

### ***Economic Expansion amid Mining and Milling Decline***

Despite the decline in uranium and other mining and milling activities after 1980 in the *west ends* of Montrose, Mesa, and San Miguel Counties, these counties *overall* did not suffer severe economic reverses. Quite the contrary, these three counties experienced significant economic expansion after the collapse of the uranium industry in the mid-1980s. These three counties added over 66,000 jobs, gained almost 73,000 new residents primarily through in-migration, and saw aggregate real income increase by two and a half fold. See Table 1.

**Table 1**

<b>Economic Vitality in the Three-County Study Area after the Last Uranium Bust: 1985-2008</b>								
Measure of Economic Vitality	Montrose		Mesa		San Miguel		Three Counties	
	Change	%Change	Change	%Change	Change	%Change	Change	%Change
Jobs	12,700	100%	47,100	50%	6,600	310%	66,400	61%
Population	15,600	60%	52,500	60%	4,570	160%	72,670	62%
Real Income (\$mill)	\$712	140%	\$3,100	140%	\$329	480%	\$4,141	148%

Source: US Dept. Commerce, BEA, REIS

This ongoing economic vitality took place despite the stagnation or decline in these three counties traditional economic bases: agriculture, mineral extraction, manufacturing, and state and federal government expenditures. It was clear both that these counties' economic bases were broader than the traditional focus on export-oriented activities and that there were new, strong, economic forces supporting these counties' economic vitality.

The dynamic, non-traditional, parts of these counties' new economic bases included:

- The growth of income not associated with current labor force activities, including retirement and investment income.
- The retention and attraction of retirees and their "foot loose" income.
- The in-migration of new residents and businesses.
- The growth of a visitor economy including tourists, recreationists, and second homeowners.

- The growing trade center role of these counties' population centers as they increasingly served larger geographic area.

Many of these new sources of economic vitality were associated with the attractiveness of this region as a place to live, work, do business, and raise a family as well as a place to visit or live part-time. This underlines the reality of ongoing economic development supported by local amenities or quality-of-life characteristics. It also underlines the economic threat associated with any activities that degrade those amenities or quality of life.

Socioeconomic analysis that primarily focuses on the potentially positive aspects of the expansion of one of the traditional export base activities such as uranium mining while ignoring its negative impacts on the primary sources of local economic vitality is misleading and dangerous to local economic well being.

### ***The Environmental Costs and Risks Associate with the Uranium Industry***

There is convincing economic evidence that people care where they live and that they act on those preferences, making economic sacrifices to pursue locations that are attractive to them and expending effort and resources to escape or avoid locations that they perceive to be inferior or noxious. That, at the most basic level, is what "high rent" and "low rent" neighborhoods are all about. Negative environmental characteristics tend to drive down property values and suppress economic vitality. It would be economically shocking if this were not true.

There are two physical characteristics of uranium mining and milling that could lead to a negative impact on the local economy. They are also the characteristics that led to costly uranium mill and mine cleanup efforts that began in the Uravan Mineral Belt area in the mid-1980s and continue today.

First, only a very tiny percentage of the uranium ore, about 0.2 percent, is actually recoverable uranium. The vanadium concentration is higher, but only about one percent. This means that huge volumes of waste "tailings" are generated in the process of recovering the uranium and vanadium.

Second, the uranium ore itself is radioactive not just due to the presence of the target mineral, uranium, but also due to the radioactive decay of the other uranium isotopes and elements in the progression of uranium decaying toward lead. Most of the radioactivity of the ore remains in those waste tailings after the extraction of the uranium. That radioactivity is the source of significant human health concerns.

Survey data confirms the negative image radioactive materials have to Colorado residents and the likely impact of the presence of those materials on residential location decisions. Other Western states that have wrestled with the benefits and costs associated with radioactive economic activities projected negative economic impacts. In a different report, the firm that Energy Fuels hired to do its socioeconomic impact

analysis for the Piñon Ridge mill projected those types of negative economic impacts associated with the transportation of radioactive materials in Nevada.

### ***The Projected Jobs and Income Impacts of the Piñon Mill Will Be Small***

The local economic impact on the West End of Montrose County of the proposed uranium mill and related mines will be quite modest. IMPLAN modeling of the rural West End indicates that the total impact on employment, including multiplier impacts will be 116 jobs. The projected impact is small for several reasons.

First, the rural West End does not have the commercial infrastructure to hold and circulate the spending associated with the mill, regional mines, and employee spending. Most of the expenditures will immediately leak out of the local economy to the larger trade centers such as Grand Junction in Mesa County. The Uncompahgre Plateau physically and economically separates Montrose County's main trade center, the City of Montrose, from the West End. That makes it inappropriate to model the West End, as Energy Fuels did, as part of a unified, countywide economy containing a major trade center.

Second, initially none of the uranium mining is likely to take place within the West End. Energy Fuels will draw on its mines in Mesa and San Miguel Counties in Colorado and Grand and San Juan Counties in Utah. The mining and haul jobs are unlikely to be primarily filled by residents of the Montrose West End.

Third, it is highly unlikely that most or all of the 85 mill jobs will go to currently unemployed workers or currently out-commuting workers who live in the West End. A broad range of applicants for the mill jobs will come from a seven-county area across two states. If Energy Fuels hires the most qualified workers, there is no reason to believe that it is only residents of the West End who will fill those jobs.

Finally, as mentioned above, workers may purposely choose to live at some distance from the mill and mines. Given the volatile nature of the mining and milling activity and the environmental damage and/or stigma associated with the mining and milling of radioactive material, workers may want to reside some distance away to protect the value of their investment in their homes. Some businesses serving the mill and mines and their workers may choose to do the same.

### ***An Alternative Development Proposal: Repair the Environment and Boost Jobs***

There are over a thousand uranium mines located in the Uravan Mineral Belt. Most of them are abandoned but represent an ongoing environmental and safety threat to people. An alternative to starting a new cycle of uranium mining, milling, and waste production in the Paradox Valley would be to focus instead on repairing the damage done to the landscape during past uranium booms and begin systematically to clean up the abandoned mines and their associated wastes. IMPLAN modeling indicates that this activity could provide the region with job creation and payroll similar to that associated

with the operation of the proposed mill: 111 jobs with annual labor income of \$9.1 million over a 20-year period or double that over a 10-year period.

### ***The Public Decision to Be Made***

In making the public decision about permitting the proposed Piñon Ridge uranium mill and its associated uranium mines, careful decision making would take into account, as carefully as possible, all of the potential positives and negatives, the benefits and costs, associated with the proposed mill. Because Energy Fuels uses its socioeconomic analysis primarily as a public relations and marketing tool for its proposed mill, that socioeconomic analysis does not provide the realistic and pragmatic view of both the costs and benefits that is necessary for rational public decision-making.

The critical question is whether the relatively small size of the expected local jobs, income, and net fiscal benefits justify the downside costs and risks associated with additional radioactive waste and pollution problems and the impact of that environmental damage and risk on the other, dominant, sources of economic vitality in the region: local natural and social amenities and quality of life that have supported immigration of new residents and businesses as well as the visitor economy. The past and expected future instability of the uranium industry and its expected impact on the reliability and duration of the small positive economic impacts also has to be considered.

To the extent that Colorado's Uravan Mineral Belt counties get caught up in a rush to rebuild the uranium industry, they may well ride the economically, socially, and environmentally disruptive uranium roller coaster once again with similar results. We need only look at the last 100 years in the Uravan Mineral Belt to see that such uranium industry roller coaster rides do not bring sustained economic vitality.

## **2. A Short Economic History of the Colorado Uravan Mineral Belt Area**

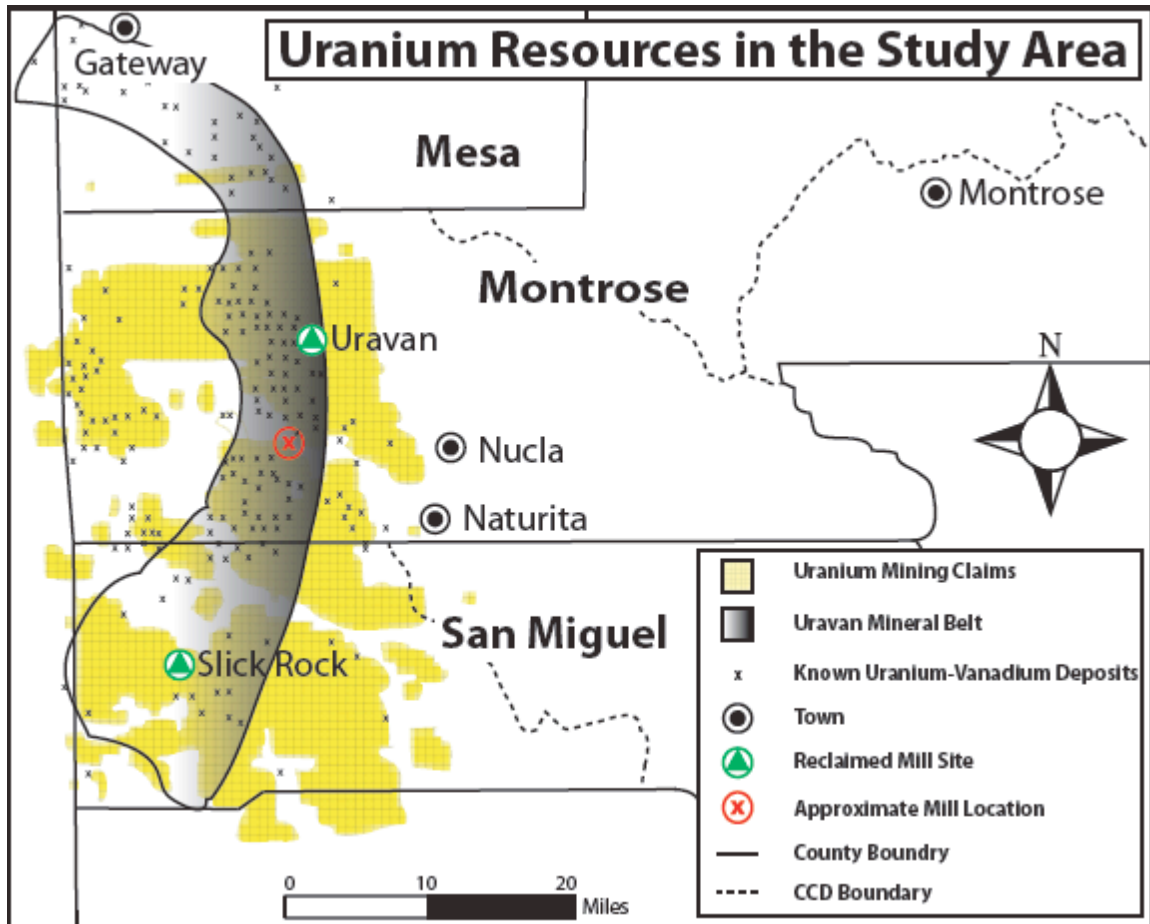
Rising uranium prices between 2004 and 2007 triggered a renewed interest in uranium mining and milling in western Colorado. New uranium claims that have been staked combined with older ones now cover most of the western portions of Montrose and San Miguel Counties in western Colorado. See Figure 1. Most of these are likely speculative claims that will never be developed, but they reflect the enthusiasm and hopes of miners and mining companies. The proposed Piñon Ridge uranium mill and its associated mines are part of that response to what thus far has turned out to be temporarily very high uranium prices. Energy Fuels bought the site for its proposed mill and began the process of obtaining the necessary permits in July of 2007, in the month following a record high uranium price of \$136 per pound.<sup>3</sup> Since then uranium prices have fell to less than a third of that value and then rebounded somewhat, reaching \$60

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<sup>3</sup> Energy Fuels website, viewed 11-3-2010, <http://www.energyfuels.com/projects/Piñon-ridge/index.html> .

per pound at the beginning of December 2010. See Figure 2. This price volatility is likely to affect the viability of the proposed mill and associated mines.

Figure 1



**Figure 1.** Map of the West side of San Miguel, Montrose and Mesa Counties in Colorado produced by Power Consulting. The known uranium-vanadium deposits are redrawn from Motica, 1970, Geology and Uranium-Vanadium Deposits in the Uravan Mineral Belt, Southwestern Colorado. The uranium mining claims are redrawn from Uranium Mining Claims in South West Colorado produced by the Southern Rockies Conservation Alliance by the Center for Native Ecosystems.

Energy Fuel's proposed Piñon Ridge uranium mill would be located in western Colorado not far from the Utah border. It would be located at about the center of the Uravan Mineral Belt that forms a crude semi-circle through western San Miguel, Montrose, and Mesa Counties in Colorado, beginning and ending in Utah, just across the Colorado border. See Figure1 above.

Figure 2

### Spot Ux U3O8 Price



Source: The Ux Consulting Company, LLC, <http://www.uxc.com/>

As the name of the mineral belt indicates, this mineralized area contains substantial deposits of uranium and vanadium ore that have been mined for almost 140 years. Initially the target mineral was radium. Later the objective was vanadium, a steel hardener. Uranium was a contaminant and waste product in those two early Uravan mineral production efforts. Then, beginning with the U.S. government's Manhattan nuclear weapons project during World War II, uranium became the primary mineral being sought. Civilian nuclear-fueled electric generation added to and continued the demand for uranium into the early 1980s.<sup>4</sup>

Over 1,200 uranium-vanadium mines were developed in the Uravan Mineral Belt, most of which are located in Mesa, Montrose, and San Miguel Counties in Colorado but the mineralized belt stretches somewhat into Grand and San Juan Counties in Utah (See Figure 1 above). Between 1936 and 1984 these mines were the source of over 84 million pounds of uranium and 220 million pounds of vanadium.<sup>5</sup> The uranium-vanadium ores produced by these mines contained very low concentrations of uranium and vanadium, currently a small fraction of one percent.<sup>6</sup> Because of that, it was not economic to ship the ores very far from the mines and concentrating mills had to be built nearby. This led to two mills being built in western Montrose County in Naturita and

<sup>4</sup> See "History of Uranium Prospecting and Mining in Colorado—a Story of Boom and Bust, *Rocktalk* 9(2), p. 4, Colorado Geological Survey, <http://geosurvey.state.co.us/portals/0/rtv9n2%20LR-web.pdf>.

<sup>5</sup> See "History of Uranium Prospecting and Mining in Colorado—a Story of Boom and Bust, *Rocktalk* 9(2), p. 4, Colorado Geological Survey, <http://geosurvey.state.co.us/portals/0/rtv9n2%20LR-web.pdf>

<sup>6</sup> Energy Fuels expects that the ore shipped to the mill would typically average 0.15 to 0.25 percent uranium oxide. Piñon Ridge Project Environmental Report, November 2009, p. 2-4.

Uravan, a mill at Slick Rock in San Miguel County, and mills in Grand Junction and Gateway in Mesa County. Mills also operated across the Colorado border in Utah at Moab and Blanding. The Moab mill ceased operating in 1984 and has been largely dismantled although its tailings continue to be the focus of relocation and remediation efforts. The Blanding, Utah, mill is the only uranium mill still operating in the United States at this time. The mill in Cañon City in central Colorado has not processed uranium ore since 2007, is not permitted to receive or process new uranium ore, and is in the process of being demolished although its owner plans to apply for permits to build a new mill at that site.<sup>7</sup>

Part of the economic impetus for the proposed Piñon Ridge uranium mill is that it has not been economic for Energy Fuels and other uranium mines to ship their ores as far as Cañon City and Blanding given how low uranium prices were for parts of the 2008 to 2010 period. In addition, when the Cañon mill was operating it was not always willing to process uranium ores, choosing instead to process alternative feed stock or simply to store nuclear waste materials at its site.

If the demand for uranium rises relative to supply, causing uranium prices to rise substantially above the \$40 per pound level that characterized part of the 2008-2010 period, a topic that will be discussed later in this report, conventional uranium mining could be revived in western Colorado especially if there were a mill within economic haul distance of the supplying mines. When prices were in the \$40 range, conventional underground and open pit uranium mining and milling was not economic which is why in 2010 there were no conventional uranium mining taking place in western Colorado despite recent investments in bringing regional uranium mines back into production.

Back in 2005 and 2006 when uranium prices were at or below average 2010 prices, about 90 percent of uranium production was being produced using chemical extraction techniques that dissolve the uranium in place in the ground and then pump the uranium-rich solution out and recover the uranium from the liquid (*in situ* mining).<sup>8</sup> If ground water quality contamination due to *in situ* mining does not have to be eliminated, those chemical mining techniques appear to have a cost advantage over conventional mining and milling, but *in situ* uranium mining can only be used in limited geological circumstances where ground water can be isolated. Concern over ground water pollution from *in situ* uranium mining has thus far prevented its use in Colorado.

Energy Fuels has indicated that most of the mined uranium that will be processed at the proposed Piñon Ridge mill will come from Energy Fuels' own mines. Energy Fuels developed a mine outside of Gateway in southwestern Mesa County literally on the Utah border, the Whirlwind Mine, which would be one source of supply. Energy Fuels'

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<sup>7</sup> *The Daily Record* Cañon, Colorado, 8/28/2010 and 8/19/2010. <http://www.canoncitydailyrecord.com/Top-Story.asp?ID=14430> and <http://www.canoncitydailyrecord.com/Top-Story.asp?ID=14507> Pueblo **Chieftan**, August 20<sup>th</sup>, 2009, [http://www.chieftain.com/news/local/article\\_1323cd57-b3f0-5151-8d75-5c554d85d5e4.html](http://www.chieftain.com/news/local/article_1323cd57-b3f0-5151-8d75-5c554d85d5e4.html).

<sup>8</sup> Domestic Uranium Production Report, July 15, 2010, U.S. Uranium Mine Production and Number of Mines and Sources, USDOE EIA, <http://www.eia.doe.gov/cneaf/nuclear/dupr/umine.html>.

Energy Queen Mine in the La Sal area of Utah to the west of the proposed mill site would be another source. Each of these mines is fully permitted and capable of producing 200 tons per day of ore. Together they could supply 80 percent of the 500 tons per day milling capacity of the proposed mill, but Energy Fuels, in its mining plan, indicates that initially only 64 percent of the uranium needed by the mill will come from those two mines. These two Energy Fuels mines, however, could supply the proposed mill for only a limited number of years. Energy Fuels also owns approximately 20 additional uranium properties in western Colorado and eastern Utah that could be used as additional sources of ore. Energy Fuels has also left open the possibility that it will purchase ore from independent mines in the area.<sup>9</sup>

### ***Economic Conditions in the Uravan Mineral Belt Region***

The proposed Piñon Ridge mill and its associated mines will primarily impact three counties of western Colorado and two counties in eastern Utah. Because the permitting decision will be made by the State of Colorado, we will focus on the three Colorado counties: Mesa, Montrose, and San Miguel.

The Uravan Mineral Belt and its associated uranium-vanadium deposits and mines are located in the extreme western portions of these three counties. These portions of the counties are very rural, often with very low populations despite the fact that each of these counties has a substantial population center.

The north end of the Uravan Mineral Belt lies in Mesa County. Grand Junction is the trade center that dominates Mesa County and most of western Colorado. Grand Junction is a metropolitan area with a 2009 population of about 60,000. But Gateway, the small Mesa County town located near the Energy Fuels' Whirlwind Mine and the only town in southwestern Mesa County, is well outside of the urban sprawl associated with Grand Junction, 55 miles to the north. The 2008 Business Patterns data from the U.S. Department of Commerce indicates that there were only five business establishments in the Gateway zip code with a total of only a few dozen employees. That data, however, does not appear to include the employment and payroll associated with either the Gateway Canyons Resort or Energy Fuels' Whirlwind Mine.<sup>10</sup> Because

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<sup>9</sup> Section 2.2.3, , Piñon Ridge Project Environmental Report, Edge Environmental for Energy Fuels Resources Corporation, November 2009, pp. 2-3 and 2.4.

<sup>10</sup> The Business Patterns information does not report self-employed individuals (sole proprietorships). Government employment is also not included. This federal data source measures employment and payroll during the week of March 12 of each year. The Business Patterns data appear not to include the employment at the Gateway Canyons Resort, which during the peak summer months employs 120 workers. That resort, however, may have much lower employment in March when the data is collected. The Energy Fuels Whirlwind mine, which EF has asserted would employ as many as 60 production worker when operating at full capacity, EF (EF VP Gary Steel, quoted in Grand Junction Sentinel, 9/3/2010), was not scheduled to open until after March 2008 when 2008 Business Patterns measured employment and payroll. The Whirlwind mine never did open in 2008 (or 2009 and 2010) because of plummeting uranium prices. In late 2008 that mine was put in stand-by mode laying off five workers and retaining only three part-time workers to maintain the mine and environmental controls. (Grand Junction **Free** Press, December 10, 2008). These two sets of circumstances likely explain why the mine was not counted in the Business Patterns data.



Gateway is an unincorporated town and too small even to be a U.S. Census designated “place,” there are no contemporary demographic or economic data on the area.<sup>11</sup> There may be between 100 and 200 residents in the town and surrounding rural area.<sup>12</sup>

The demographic and economic situation at the southern end of the Uravan Mineral Belt in San Miguel County is similar. About 80 percent of the county population is located in the southeastern third of the county adjacent to Telluride. In 2009 about 40 percent of the county population was located just in the towns of Telluride and Mountain Village. On the other hand, the western third of the county, the part containing the southern end of the Uravan Mineral Belt, had only two percent of the county population, a mere 141 residents, in 2000.<sup>13</sup> This west end of San Miguel County contains the town of Slick Rock, where two different uranium mills serving surrounding uranium mines operated on and off until 1961, as well as the town of Egnar. The 2008 County Business Patterns data indicated that there were only six business establishments in the west end of San Miguel County with a total of only 77 employees. This is a rural area with unusually low population and economic density.

The west end of Montrose County, where the proposed Piñon Ridge mill would be located, sits in the center of the Uravan Mineral Belt. While the immediate area around the proposed mill site and the Paradox Valley stretching west to the Utah border are also very lightly settled areas, the west end of Montrose County does have significant population centers in the “twin” cities of Nucla and Naturita about 15 miles east of the proposed mill. The combined population of these adjacent towns was about 1,400 in 2009, about evenly divided between them. The much smaller town of Paradox, located about 15 miles west of the proposed mine site, has 230 residents in its zip code area.

In comparison to the Uravan Mineral belt areas in Mesa and San Miguel Counties, the west end of Montrose County has a significantly more diversified economy. The County Business Pattern data for the whole of the Montrose west end indicate that in 2009 there were 71 businesses employing 519 workers. Ninety percent of these jobs were in the adjacent towns of Naturita and Nucla.

The very small town and rural character of most of the areas within the Uravan Mineral Belt is important in understanding the likely local and regional economic impacts associated with the proposed Piñon Ridge mill and associated mines. In rural areas and small towns the people who live there may well not work or shop where they live. Those that work there may not live or shop there and those that shop there may not work or

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<sup>11</sup> The U.S. Census identifies the Glade Park-Gateway County Division but this area includes parts of Grand Junction and Fruita and the residential and business sprawl surrounding the Grand Junction metropolitan area. No data are available on Gateway itself and the surrounding rural area.

<sup>12</sup> For the U.S. Census years 1930 through 1950, the Census identified “minor civil divisions” labeled “precincts,” including Gateway. This 20 by 20 mile geographic area covered the entire southwest corner of Mesa County beginning about 35 miles south of Grand Junction. Sixty years ago there were about 200 residents in the area surrounding and including the town of Gateway.

<sup>13</sup> The west end of San Miguel County is the Gladel Census County Division and contains the towns of Slick Rock and Egnar. In between the Telluride Census County Division and the Gladel CCD is the Norwood CCD, which has the balance of the population.

live there. Because of the incomplete nature of such rural and small town economies, residents are likely to commute in or out to work and shop. For instance, the 2000 Census indicated that in the West End of Montrose County almost three-quarters of residents work outside of the towns in which they live and almost a third work outside of Montrose County itself. That means that the impact of additional employment and payroll is likely to be diffused over a relatively large geographical area and not be focused locally.

Consider a few examples. The Gateway Canyons Resort was reported to provide a shuttle service between Gateway and Grand Junction for 40 percent of its workforce, about 50 workers in peak season. Another third of all of the resort workers lived at the resort in employee housing but were not permanent residents of Gateway.<sup>14</sup> Only about a quarter of the workforce is from the surrounding area. Given the very limited commercial infrastructure in the Gateway area, almost all shopping takes place in the Grand Junction area. When and if the Energy Fuels' Whirlwind Mine opens, it is likely that it too will draw its employees from a very wide geographic area, including Grand Junction, not primarily from the Gateway area.

Residents of Nucla and Naturita are said to commute to the Telluride area where there are a broader range of jobs in construction, retail trade, and services.<sup>15</sup> Although Nucla and Naturita are located in Montrose County and the City of Montrose is a major regional trade center, there is no direct highway route to the city of Montrose across the Uncompahgre Plateau. For that reason a significant amount of Nucla and Naturita spending flows to the Grand Junction area. That relative isolation from the Montrose city may be one of the reasons that more complete economies developed in the Montrose County's west end in the cities of Naturita and Nucla.

Workers in mining and mineral processing have to be relatively mobile, taking jobs wherever they happen to open up. In addition, mineral industry workers know that employment and income at any given location can fluctuate with international prices and economic conditions and that mines are ultimately depleted. To protect the value of their investment in their homes, miners and mill workers are likely to choose to live in more diversified economies rather than in a mining town or mill town so that when a mine or mill shuts down, the value of their and other workers' homes are not threatened. Because of the instability of employment in the minerals industries, mineral workers regularly commute long distances to jobs. Mineral jobs are often not filled by "local" residents but by in-commuting workers or relocating workers. Clearly in southwestern Mesa County and western San Miguel County that almost has to be the case since there are so few local residents to begin with. But given the pattern of long distance commuting in rural areas, it is also likely to be the case in the West End of Montrose County.

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<sup>14</sup> *Grand Junction Sentinel*, September 3, 2010, Penny Stine.

<sup>15</sup> The 2000 Census of Population provides information on commuting patterns at the sub-county level. As mentioned earlier, for the West End of Montrose County (Nucla Census County Division) a third of the working residents reported commuting outside of Montrose County to work.

## ***Mineral Development and Local Economic Development in the Colorado Uravan Mineral Belt***

Obviously the Uravan Mineral Belt region is not unfamiliar with uranium mining and milling activity. Over the last one hundred years the region has been through several booms and busts. Between 1910 and 1921 the uranium-vanadium ores were mined to extract radium for medical and illumination purposes. During World War I, the demand for vanadium for strengthening the steel used for military equipment also supported mining in the Uravan region. When much richer uranium ores were discovered in Africa in the early 1920s, the Uravan ores could not compete and the mining and processing activities largely halted with virtually no production between 1923 and 1937.

With the build up to World War II, the demand for vanadium was revived by the military and the federal government's secret development of nuclear weapons created a demand for uranium from the Uravan area. After a post-war lull, the federal government through the Atomic Energy Commission triggered a much more substantial mineral boom by entering into long-term contracts that included guaranteed prices for uranium ore production and guaranteed cost recovery and return on investments in uranium mills. This government-supported demand for uranium maintained a two-decade-long period of mining and milling in the Uravan region, from 1948 to 1970. The federal government began to phase out those financial subsidies supporting the uranium industry in the 1960s and ended them in 1970.

After 1970, uranium production and sale largely became private, commercial, operations, subject to the same sort of competitive pressures and cycles that characterized other mineral businesses. As a result, many of the older uranium mills and buying stations closed. The demand for nuclear fuel from civilian nuclear electric power plants supported some ongoing mining and milling operations in the Uravan region as uranium prices rose relative to the fixed prices previously maintained by the federal government. Those higher prices triggered expanded production across the United States. Accidents at nuclear power plants in the United States and the Soviet Union as well as the build out of the initial set of civilian nuclear power plants in the United States led to a stabilization and then decline in the demand for uranium, and in the late 1970s the price of uranium plummeted, leading to an almost complete shutdown of the uranium mining and milling industry by the mid-1980s.<sup>16</sup>

### ***The West End of Montrose County***

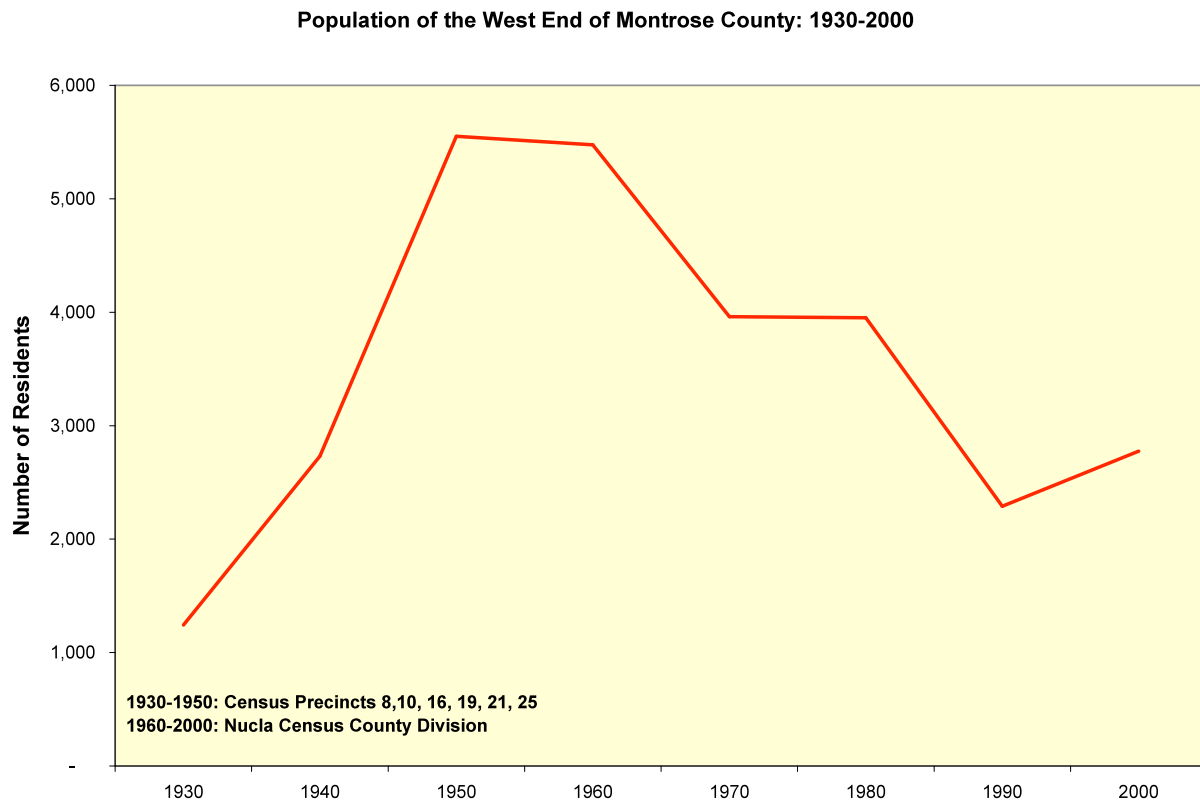
In the Montrose County portion of the Uravan Mineral Belt, the expansion of uranium and vanadium production between 1930 and 1960 led to a major expansion of the economy. The population increased over four fold from 1,200 to 5,500. As the federal government phased out its subsidization of uranium mining and milling, the uranium

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<sup>16</sup> For a history of the booms and busts in the Uravan Mineral Belt and in the national uranium industry see "History of Uranium Prospecting and Mining in Colorado—a Story of Boom and Bust," Rocktalk 9(2):4-9, Fall 2006 ; Colorado Geological Survey; "U.S. Regulatory History of Uranium Mills, Appendix A of the Piñon Ridge Project Environmental Report, November 2009, Energy Fuels Resources.

industry in western Montrose County began to shrink almost as dramatically as it had expanded. The population fell from 5,500 in 1960 to 2,300 in 1990. As the population data indicates, the uranium industry began to shrink somewhat in the Montrose County West End in the late 1950s. The uranium mill in Naturita closed in 1958, was replaced by an upgrader plant that, in turn, was shut down in 1963 and the mill site was dismantled. The high uranium prices in the 1970s stabilized the Montrose County West End population briefly but as the uranium industry nationwide shut down in the early 1980s, the same thing happened in the West End of Montrose County. See Figure 3.

**Figure 3.**



Nationwide the uranium industry expanded production through the 1970s despite the end of federal subsidies, buoyed by then rising market-based uranium prices. See Figure 4. However, in Montrose County employment in metal mining, primarily uranium mining, initially fell dramatically, eliminating almost half the mining jobs as federal subsidies ended. Metal mining employment then rebounded in Montrose County, largely following the national expansion in uranium production during the 1970s. By 1978 there were 100 more mining jobs than at the start of the 1970s. Then, however, also following the nation uranium production trend, uranium employment in Montrose County's West End plummeted to near zero levels by the late 1980s. See Figure 5.

Figure 4

### Uranium Price and U.S. Production

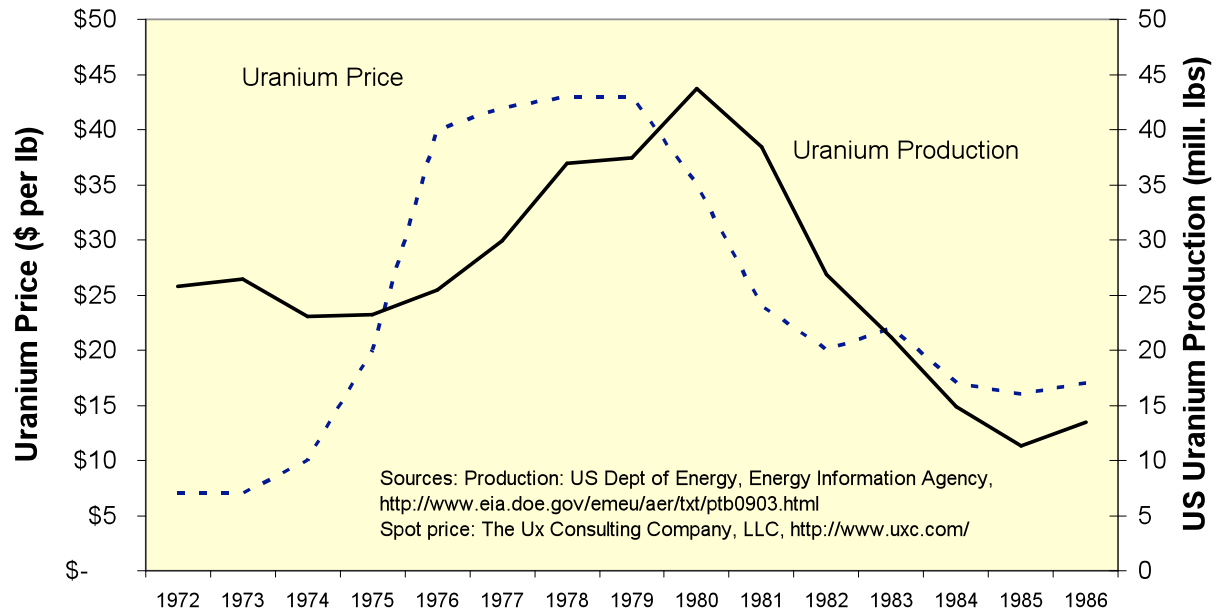
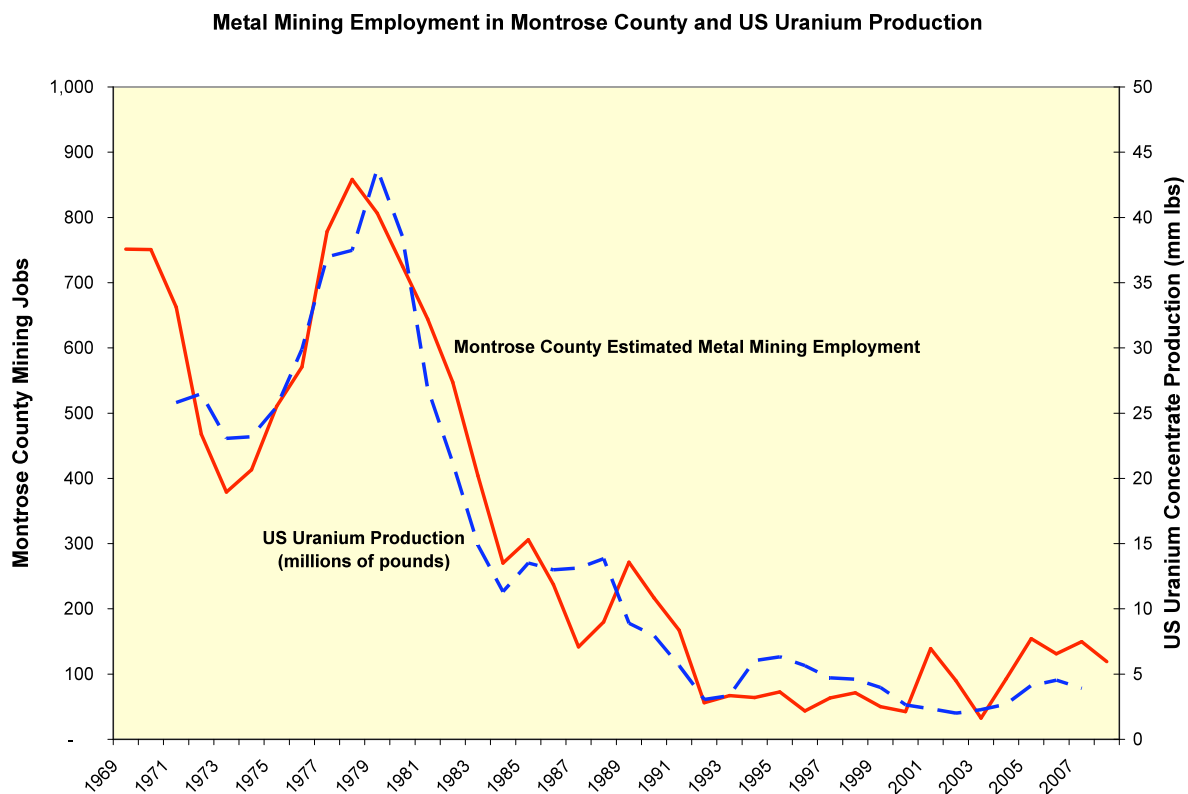


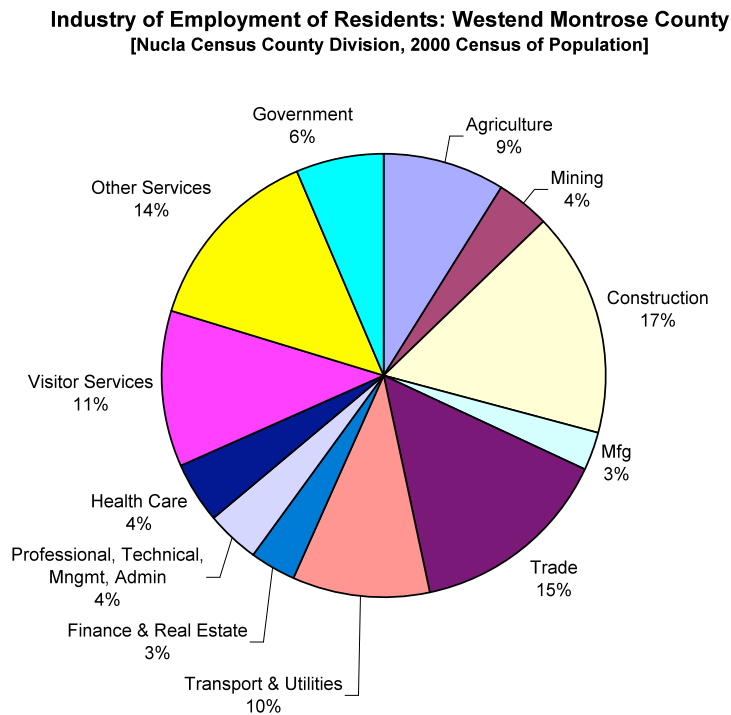
Figure 5



In 1986 the town of Uravan, which in 1950 supported a population of over 600 in the town and the surrounding area, was evacuated by the federal government. The town was then demolished, all 260 structures in the town, as part of what was to become a two-decade effort to stabilize and remediate the radioactive material from almost a century of uranium mining and milling.

By 2000, two decades after the uranium industry collapsed in the West End of Montrose County, the population of the area had stabilized at 1930-1950 levels and had begun to grow modestly. The economy supporting residents now is a relatively diverse one with only modest dependence on mining. The detailed results of the 2010 Census are not yet available, but the 2000 Census revealed the mix of economic activities that support the residents of the West End. See Figure 6. These jobs that residents hold, however, are not necessarily *in* the West End towns or even in the West End of Montrose County. The 2000 Census indicated that almost three-quarters of residents work outside the towns in which they reside and almost a third work outside of Montrose County.

**Figure 6**



In 2000 mining was still the source of 4 percent of jobs. This would include the New Horizon coal mine that supplies the Nucla Station electric generator operated by the Tri-State Generation & Transmission Association. The presence of that electric facility also explains the relatively large role of Transportation and Utilities in the local economy. Figure 6 shows 10 sectors in the West End economy that provide as many jobs or more than mining in 2000.

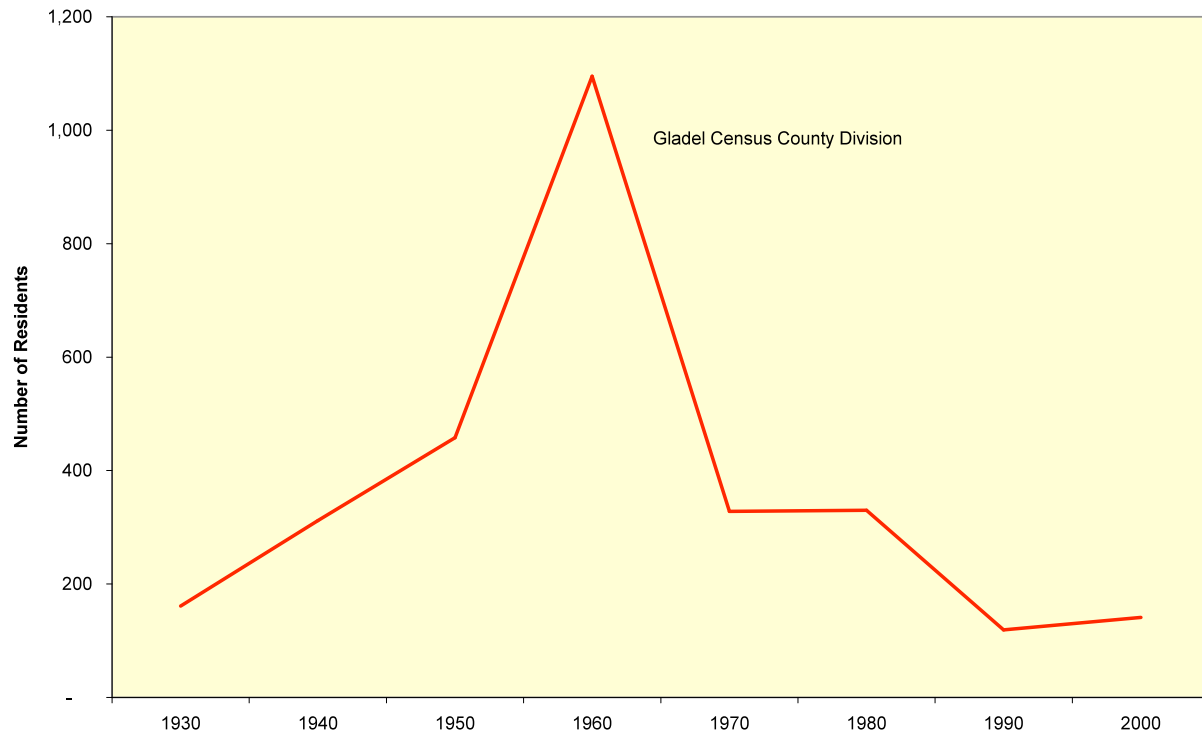
### *The West End of San Miguel County*

In the Uravan Mineral Belt region in the west end of San Miguel County, uranium production was centered on the area around the unincorporated town of Slick Rock where a uranium mill was first built in 1931 but abandoned in 1943. A separate concentrator was built in 1957 at a different Slick Rock site and operated until 1961. By 1982 the concentrator plant buildings and equipment had been removed from the site. The uranium milling and related mining led to a significant increase in the population of the west end of San Miguel County. It rose from 161 in 1930 to almost 1,100 in 1960, a seven-fold increase. After the closing of the mill, the population fell to below its earlier levels, to 119 in 1990 and 141 in 2000. See Figure 7. This west end Census County

Division contains about 544 square miles implying a population density of about 1 person for every 4 square miles of land area.

**Figure 7.**

**Change in Population: West End of San Miguel County**

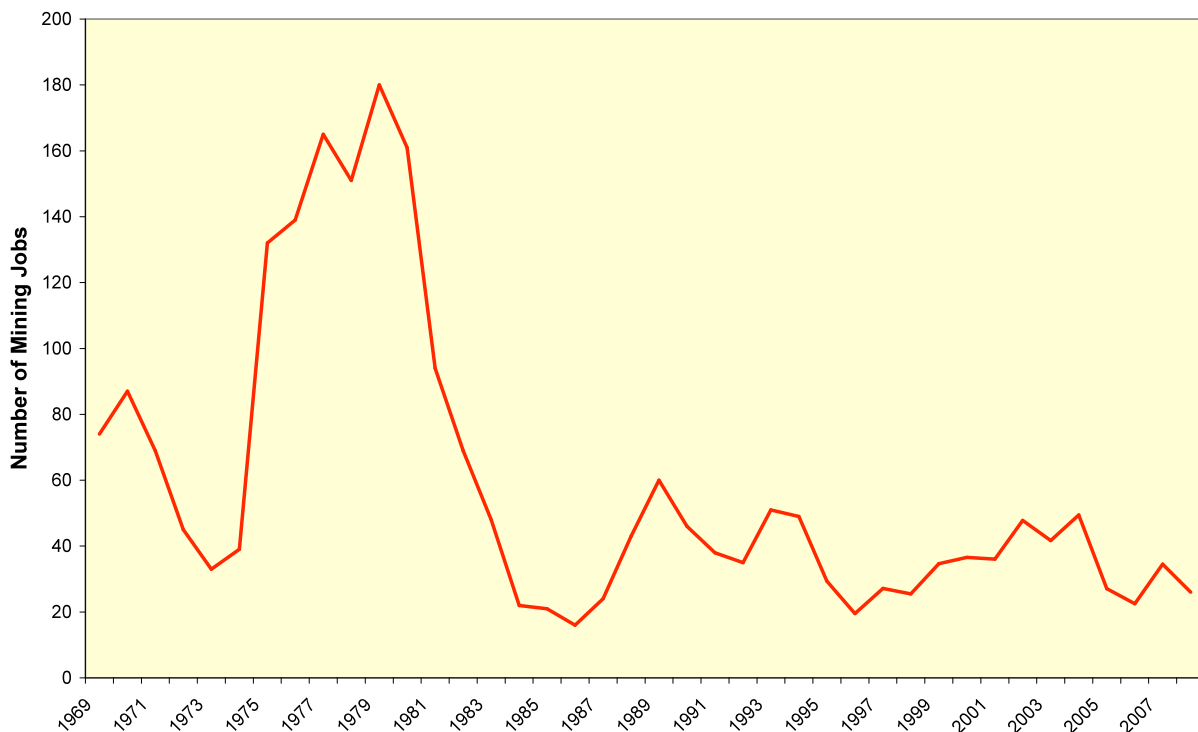


The apparently stable population in the 1970 to 1980 period is misleading because we only have population information at the sub-county level every ten years when the federal Census is carried out. Between 1970 and 1980 mining employment in San Miguel County almost doubled but then, during the 1980s fell to near zero. See Figure 8. below. Between 1970 and 1980 mining employment grew by 74. Adding those 74 mining jobs might be expected to have lead to an expansion in the population, but after one boom and bust in the 1960s, miners may have been hesitant to move to the west end of San Miguel County for what was to again be a smaller boom and bust.



**Figure 8.**

**Estimated Mining Employment: San Miguel County, CO**



### *The West End of Mesa County*

At the north end of the Uravan Mineral Belt in southwest Mesa County, a uranium mill was built in Grand Junction in 1950, one of the first mills built specifically to produce uranium as the primary product and vanadium as a byproduct. That mill operated as long as the subsidies implicit in its contracts with the Atomic Energy Commission lasted. The last contract expired in 1966. The mill tried to operate serving the private commercial market but was closed permanently in 1970. It did not benefit from the increase in uranium prices and market opportunities in the 1970s.

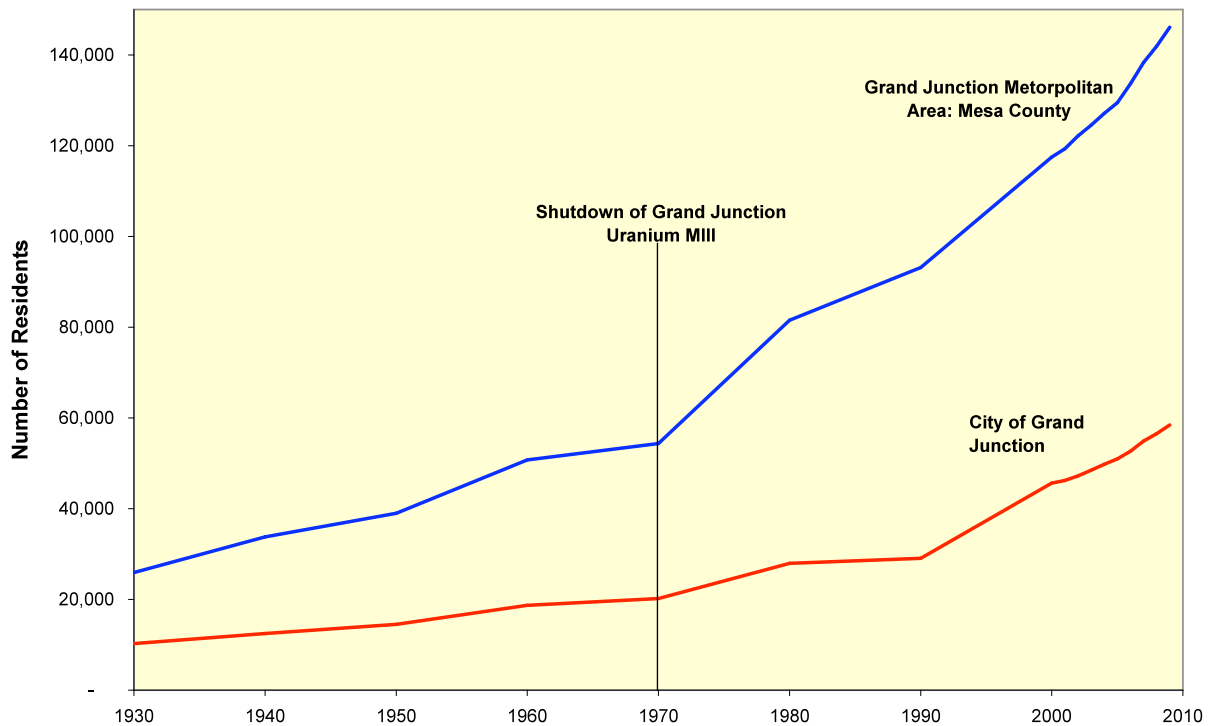
Because Grand Junction is a major trade center for western Colorado and a metropolitan area with a diversified economy and 50,000 residents in 1970, the shut down of a single uranium mill served by mines lying outside of the city and the loss of a few hundred jobs was unlikely to have had a major impact.

Despite the loss of the uranium mill and, assumedly, the loss of some of the mines supplying the mill, the growth of the city of Grand Junction economy and the greater Grand Junction metropolitan area (Mesa County) accelerated between 1970 and 1980 rather than slowing down. A much broader range of economic activities was driving this metropolitan area than uranium milling. See Figure 9. Some of this expanded economic

activity in the 1970s was mineral-related as metal mining (including uranium mining), coal mining, and oil and gas extraction expanded during the 1970s before collapsing in the 1980s. But the overall economy in the Grand Junction area continued to expand despite the overall mineral sector collapsed during the 1980s. See Figure 10.

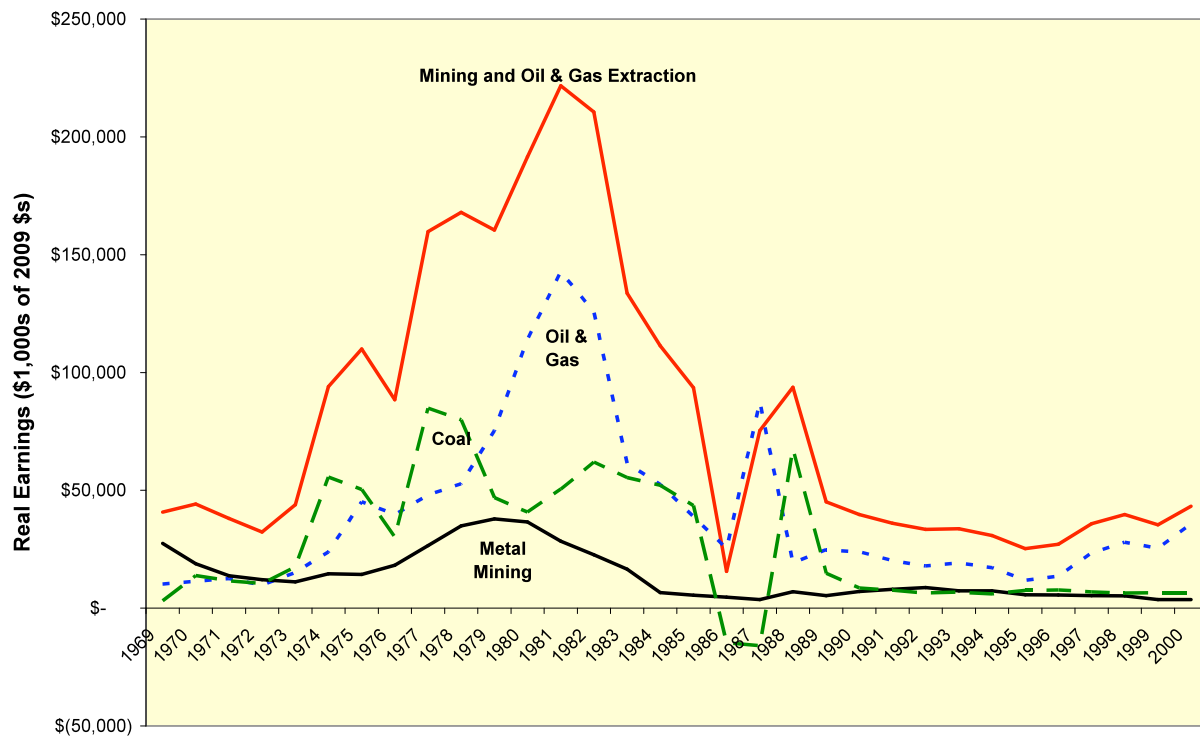
**Figure 9.**

**Population Growth: Grand Junction, Colorado**



**Figure 10.**

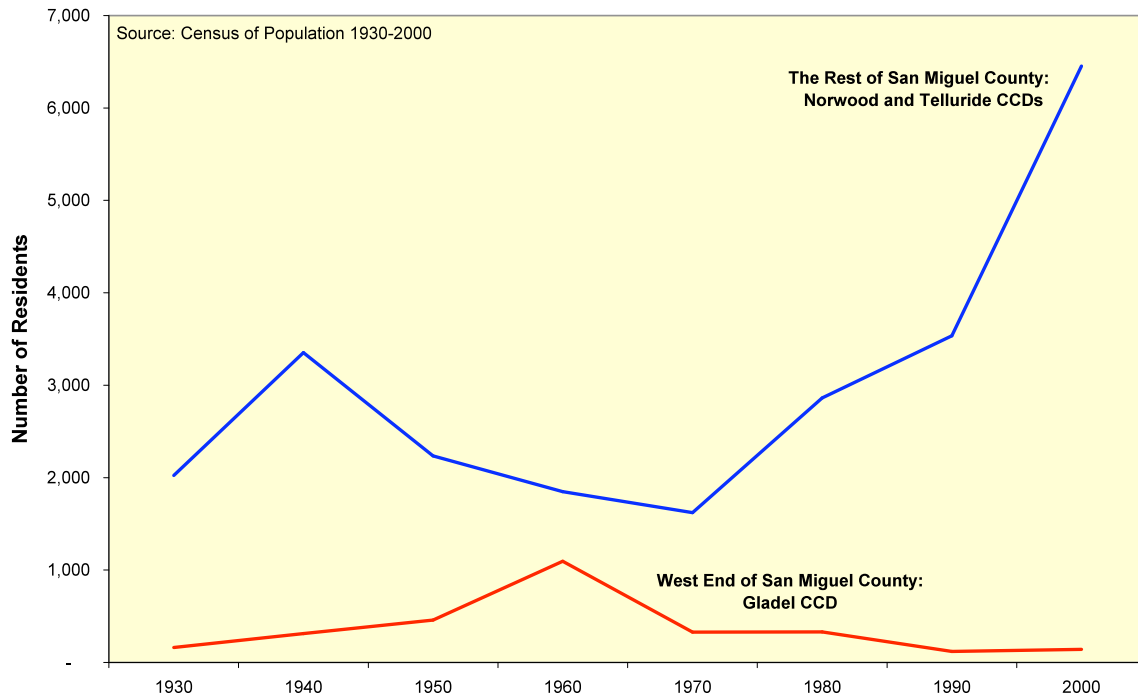
**Real Earnings in Mineral Extraction: Mesa County, CO**



This absorption of the loss the uranium sector without significantly damaging the larger economy was not limited to the Grand Junction or the Mesa County economies. The same phenomenon is apparent in the San Miguel and Montrose County economies where the loss of jobs and population in the west ends of the counties took place simultaneously with the expansion of the rest of the county economies. For instance, as the workforce and residents drawn to the west end of San Miguel County during the uranium boom of the 1940s and 1950s began to dissipate during the 1960s and 1970s, growth elsewhere in the San Miguel County expanded dramatically with the population increasing four-fold between 1970 and 2000. See Figure 11 below.

**Figure 11**

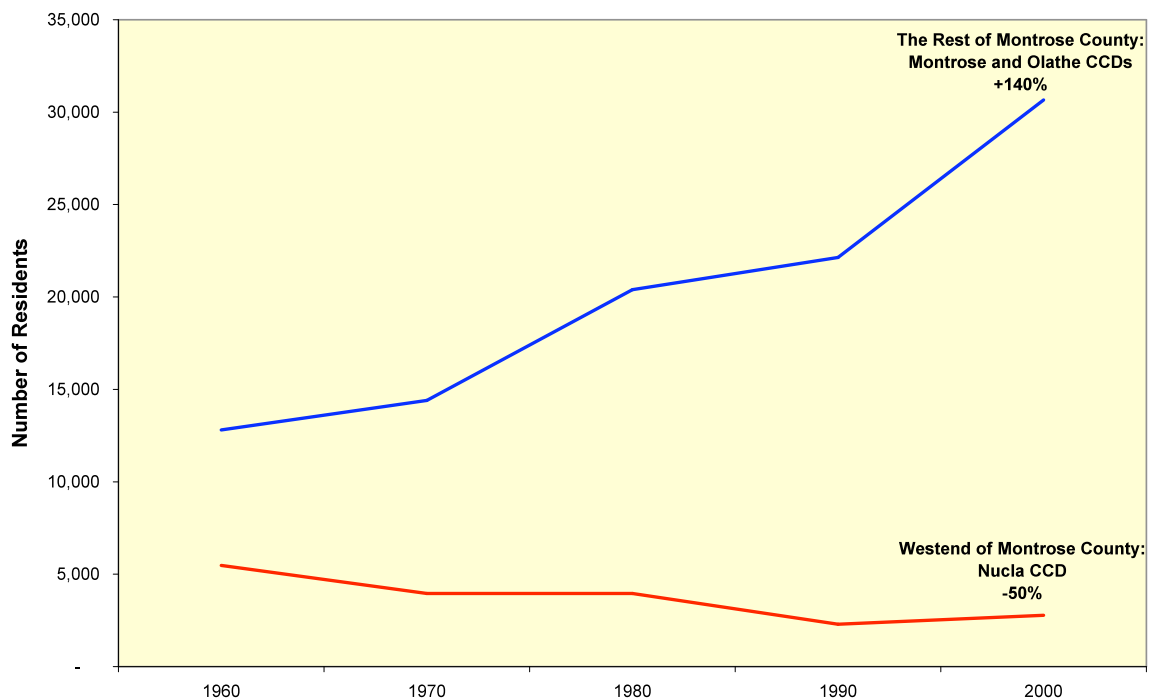
**Population in West End of San Miguel County and the Rest of the County**



In Montrose County a similar pattern is found. As uranium mills and mines in the West End shutdown and population declined, the rest of the county economy, largely centered around the city of Montrose, expanded significantly. While the population of the uranium-dependent West End cities of Naturita and Nucla *declined* by 25 percent, the more diversified cities of Montrose and Olathe expanded 3.5 fold between 1960 and 2009. While the whole of the uranium-dependent West End lost half of its population between 1960 and 2000, the Greater Montrose area saw its population increased 140 percent. See Figure 12 below.

Figure 12

Population of the Westend and the Rest of Montrose County



*Uranium Production and West End Economic Development: Conclusions*

There are several lessons that can be taken from this brief economic history of the role that the uranium industry has played in the west ends of Mesa, Montrose, and San Miguel Counties.

- i. The uranium industry has had almost no permanent economic development impacts in the purely rural parts of the Uravan Mineral Belt. In the Slickrock area of western San Miguel County and the Gateway area of southwestern Mesa County, the population has largely fallen back to the very low densities that existed before the WW II uranium boom.<sup>17</sup>
- ii. In the West End of Montrose County there were more substantial settlements before the uranium boom. “Utopian” communal settlement in the Nucla-Naturita area at the beginning of the 20<sup>th</sup> century led to the development of irrigated agriculture and higher population densities compared to the open-range cattle ranching of the surrounding area.

<sup>17</sup> In 1930 there were 161 residents in the west end of San Miguel County. In 2000 there were 141. In 1960 there were 1,100 residents. In the West End of Montrose County there were 2,732 residents in 1940 and in 2000 there were 2,776. The Gateway area of Mesa County was never a Census County Division or a Census Place by itself. For that reason historical population data is not readily available for that area.

Irrigated agriculture also played a role in the area around the town of Paradox at the other end of the Paradox Valley. The relative isolation of these areas from larger trade centers led to the development of a more diversified commercial infrastructure than would have been found if the area were within easy reach of other trade centers. Uranium mining, of course, had a significant impact, boosting populations significantly. But as uranium declined, these communities were dramatically and painfully downsized, back towards pre-uranium boom levels and one town, Uravan, disappeared completely.

- iii. The 1950-1970 boom in the uranium industry was not a market phenomenon. The expansion of the industry was supported by the federal government as it sought to assure a ready supply of nuclear materials to support American weapons programs during the Cold War. Without that federal government support, there would likely have been more instability in the uranium industry than was actually experienced until that government support was removed. The market supported uranium expansion of the 1970s lasted less than a decade before market forces brought it to an end.
- iv. The population declines in the west ends of these counties were not tied to a lack of economic potential in western Colorado or in these three counties. While population was falling back to levels seen in the early 20<sup>th</sup> century in these mining-dependent areas, the economies elsewhere in these counties were expanding significantly. We will discuss that economic vitality in the face of the relative decline in mining in the next section of this report. Here we simply wish to point out that this economic vitality was tied to the much more diverse nature of these western Colorado economies and their ability to attract and hold new residents and new businesses. As will also be discussed later, mining and mill towns often have difficulty diversifying and developing in this way partially *because* they are dependent on mining.

### **3. The Economies of Our Three-County Study Area: Mesa, Montrose, and San Miguel Counties**

#### ***Economic Vitality in the Face of Declines in the Mining Industry in Western Colorado***

As pointed out above, the west end areas of our three-county study area that came to rely on the uranium industry have been through enthusiastic booms and painful busts but have not been left with more prosperous local economies. Meanwhile, the more diversified parts of these counties have seen sustained economic development and vitality.<sup>18</sup> Given that mining usually pays significantly above average wages and is regularly trumpeted as bringing local prosperity in its wake, it is important to explore this economic anomaly.

Changes in local economies are usually explained in terms of the expansion or contraction of export-oriented economic activities. This “export base” or “economic base” view of the engine driving the local economy is built around the dollars these economic base activities bring into the local economy, which then get spent, and re-spent amplifying or “multiplying” the local impacts.

The export-oriented economic activities traditionally have been identified as agriculture, mineral extraction, manufacturing, and government activities that are not tied to serving local residents such as military installations or state or federal prisons.

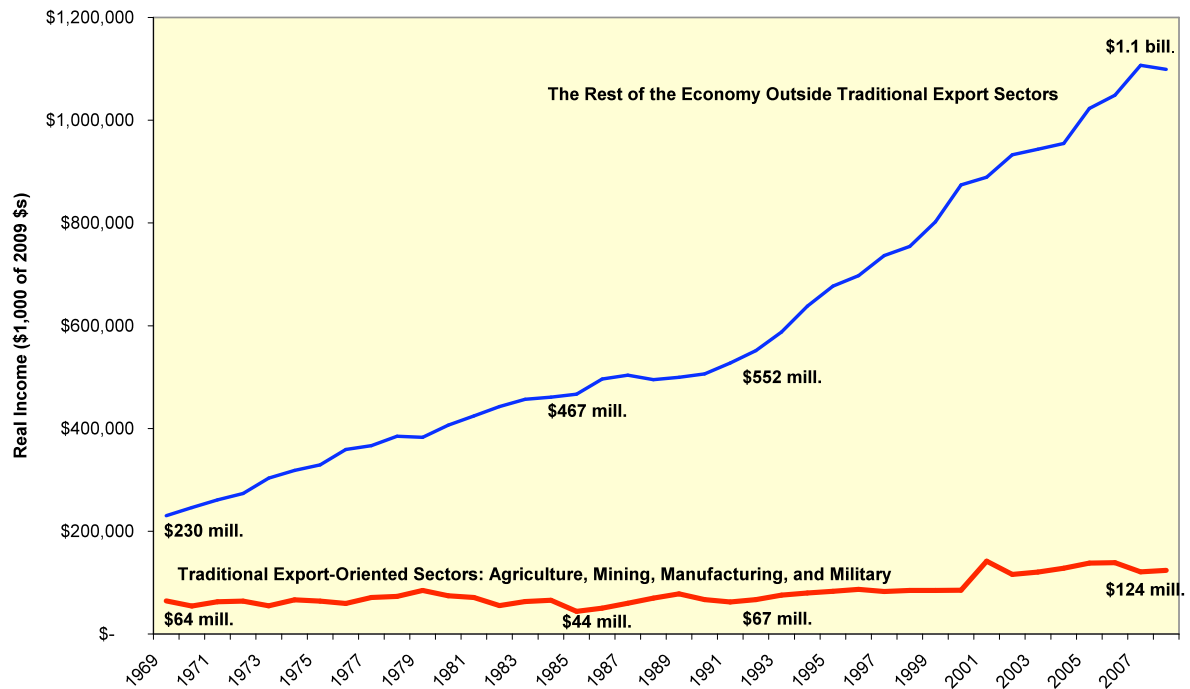
That view of our three-county study area, however, is of limited usefulness because for long periods over the last forty years, the traditional export bases of these counties have not expanded, but other sources of income did expand in an impressive way. Montrose County provides a good example. Between 1969 and 1985, the traditional export base shrank by about a third while the rest of the economy more than doubled. By 1992 the traditional economic base had regained its 1969 level, but the rest of the economy was generating 2.4 times as much real income as it had in 1969. By 2008 the traditional export base had doubled the real income it was producing, but the rest of the economy had expanded almost five fold. See Figure 13.

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<sup>18</sup> The financial crisis and Great Recession that began in 2008 has had an impact across the nation. For the period for which we have population estimates (through 2009), The Telluride area and San Miguel County have seen almost no growth since 2007. Montrose City and Grand Junction have seen ongoing population growth between 2007 and 2009 as did Montrose and Mesa Counties. The cities of Nucla and Naturita saw almost no growth. However, real personal income in both San Miguel and Montrose Counties turned downward in 2008 as the recession got underway.

**Figure 13**

**Traditional Export Sectors and the Rest of the Economy: Real Income  
Montrose County, CO**

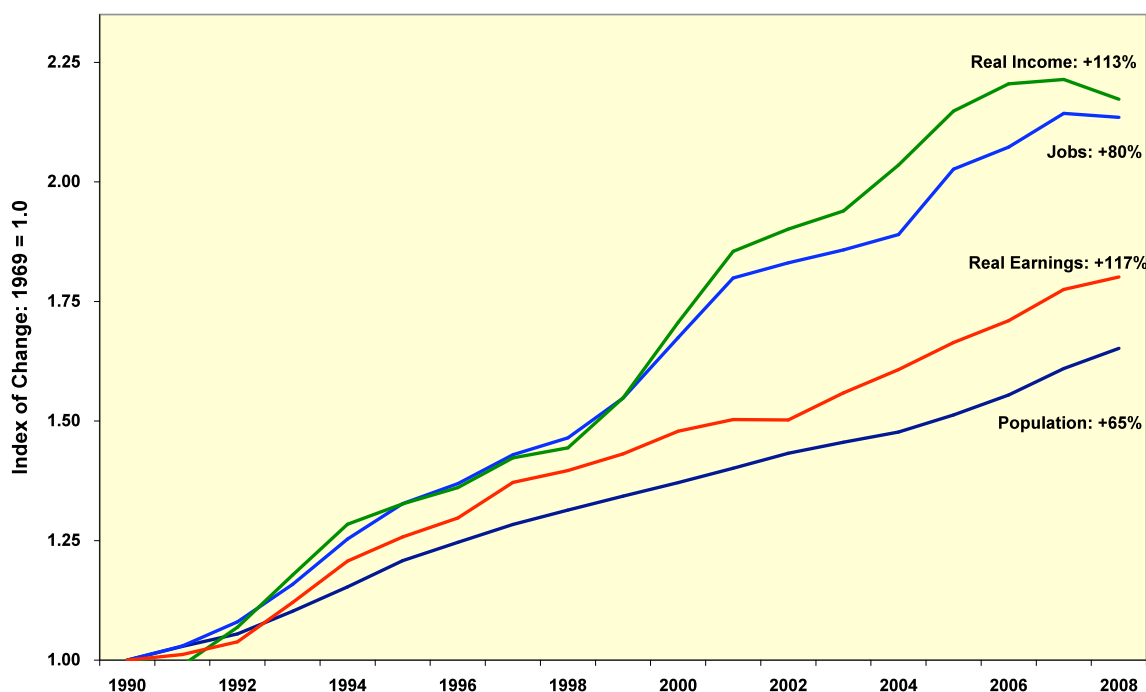


Clearly there were economic forces afoot in Montrose County creating considerable local economic vitality other than the traditional economic base. Between 1990 and 2008 total real pay, with inflation remove, for residents rose 117 percent, total personal income increased 113 percent, jobs expanded by 80 percent, and population grew by 65 percent. See Figure 14



**Figure 14**

Indicators of Local Economic Vitality: Montrose County



Similar patterns can be found in San Miguel and Mesa Counties. In San Miguel, the traditional export base declined between 1969 and 2004 but real income in the rest of the economy expanded ten fold. In Mesa County the real earnings in the export sectors was less in 2005 than it was in 1981, yet income received from other sectors on the economy had more than doubled.

The source of new income and earnings despite the shrinkage in parts of the traditional export base are found in a variety of sectors that often are not treated as independent sources of growth in the local economy. These include investment and retirement income that flows to owners of assets and retirees wherever they make their residences. Construction activity associated with in-migrating new residents, new businesses, second homeowners, and other parts of the visitor economy also were a major source of new income. Health services, other professional services, financial and real estate services, and retail and wholesale trade were also importance sources of expansion. These are often treated as serving only local residents and not drawing new income into the local economy. However, cities that reach a certain size become regional trade centers providing services to customers outside of those urban centers. They also serve visitors and are part of the visitor economy. Finally there are services that are aimed primarily at visitors, including recreation and entertainment services, accommodations, and eating and drinking establishments.

Table 2 shows the sectors of the three county economies that were the primary sources of expansion in real income between 1990 and 2008, the latest data available at the time this report was written, November 2010. Note that mineral extraction, including oil and gas production, continued to play a significant role in these counties during this period. Out of the ten economic sectors listed, mineral extraction was the 3<sup>rd</sup> most important sources of the growth in real income in Mesa County, the 6<sup>th</sup> most important source of growth in Montrose County, and the 7<sup>th</sup> most important source of growth in San Miguel County.

However, almost all of this increase in earnings in mineral extraction between 1990 and 2008 was associated with increased earnings in oil and gas operations after 2000 rather than increases in mining activity. In Mesa County, for instance, labor earnings in mining fell after 1990 and all of the growth in mineral extraction earnings was due to expansion in oil and gas production. In Montrose County, the \$40 million increase in real income from mineral extraction was associated with a \$42 million change between 2000 and 2001 in the estimated self-employment income associated with oil and gas sole proprietorships. This caused mineral extraction earnings to jump from about \$9 million in 2000 to \$51 million in 2001.<sup>19</sup> Estimated metal mining employment actually declined during this period and 87 percent of the increase in labor earnings in mineral extraction was in oil and gas production. In San Miguel County all of the growth in labor earnings between 1990 and 2008 in mineral extraction were in oil and gas production while estimated earnings in metal mining declined.

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<sup>19</sup> The U.S. Department of Commerce BEA Regional Economic Information System provides data on both wage and salary earnings by industry as well as total earning including estimated self-employment income that is based on Internal Revenue data and the address of the tax return. Comparing these two Montrose County data sets allows the self-employment income by industry to be identified. The large six-fold increase in oil and gas labor earnings between 2000 and 2001 appears to be a change in industry definition or a change in the geographic area to which this self-employment income was assigned rather than an actual change in economic activity in Montrose County. It is also uncertain whether this income actually is spent and circulates in Montrose County.

**Table 2**

Sources of Additional Real Income: 1990-2008

Economic Sector	Montrose County		San Miguel County		Mesa County	
	Change in Real Income (\$millions)	% of Total Change in Real Income	Change in Real Income (\$millions)	% of Total Change in Real Income	Change in Real Income (\$millions)	% of Total Change in Real Income
Investment and Retirement Income	\$252	39%	\$105	37%	\$909	32%
Other Services	\$84	13%	\$48	17%	\$368	13%
Construction	\$83	13%	\$38	14%	\$309	11%
State & Local Government	\$63	10%	\$27	10%	\$188	7%
Retail/Wholesale Trade	\$61	9%	\$13	5%	\$217	8%
Health Services	\$47	7%	\$7	2%	\$286	10%
Finance, Insurance, Real Estate	\$35	5%	\$43	15%	\$161	6%
Visitor Services	\$18	3%	\$38	14%	\$94	3%
Mineral Extraction	\$40	6%	\$8	3%	\$317	11%
Manufacturing	\$25	4%	\$7	2%	\$50	2%
Total of These Sectors	\$708	109%	\$334	119%	\$2,899	102%
Total Increase in Real Income	\$650	100%	\$281	100%	\$2,843	100%

Source: U.S. Dept. Comm, BEA, Regional Economic Information System

### ***Defining the “Economic Base” of the Study Area Counties***

There are two explanations for the failure of the “traditional export base” to explain the actual economic vitality exhibited by the three counties in our study area. First, the “traditional” definition may be misleading. It may ignore other sources of income that flow into the local economy. The second is that the “economic base” approach to understanding the local economy may be incomplete. That view may ignore other economic forces that can drive the local economy. As we will see, these are related explanations, both of which require us to think more comprehensively about the sources of local economic vitality and well being. We will first discuss the need to more carefully define the sources of income flowing into these local economies. We will then turn to the need to supplement the economic base approach with a broader view of the sources of local economic vitality.

The “traditional” export base tends to focus on those land-based activities that facilitated the original European-American settlement of the West: Ranching, farming, mining, timber harvest etc. In addition, the industrialization of the economy in the twentieth century is recognized by including manufacturing. As the word “traditional” suggests, this tends to be a view of the local economy that is tied to a past economic reality that is reinforced by the continued significant presence of these economic activities in the contemporary economy. There may, however, be relatively new sources of income flowing into local economies that this focus on the past tends to ignore.

The most obvious of these have been mentioned above in discussing the major sources of increased employment and income over the last two decades:

- i. The importance of investment, retirement, and other flows of income not associated with current participation in the workforce. Some have labeled

this type of income “non-employment” income. We have labeled it above “investment and retirement income.”

- ii. The role of the spending of visitors and part-time residents on the local economy. Above we labeled that the “visitor economy.”
- iii. The role that urban areas can play as trade, service, entertainment, and educational centers that draw expenditures from the residents of the surrounding region.

#### *i. Investment and Retirement Income*

Although we often discuss household income as if it almost exclusively comes from wages and salaries, there are other income flows that have become increasingly important to households and local economies that are not related to current participation in the workforce. Social Security, Medicare reimbursements of medical expenses, veterans’ benefits, etc. flow to most retirees. In addition, many citizens, both retired and working receive dividends, interest, and rents from past investments they have made directly themselves or through a retirement plan. Finally there are federal programs that seek to temporarily support people with low or interrupted incomes: unemployment compensation payments, food stamps, Medicaid reimbursements for low income households’ medical expenses, etc.

Together these forms of non-employment income have made up about 40 percent of the income received by households since the mid-1980s. Put slightly differently, this non-employment income adds about two-thirds to employment income to make up total income. Clearly these non-employment income flows represent a very substantial flow of income into the local economy.<sup>20</sup> Figure 16 shows how these income flows contributed to total income in Montrose County over the last 40 years. Mesa and San Miguel Counties show a similar pattern although non-employment income makes up a somewhat smaller percentage of total income, 34 to 37 percent respectively. Note that income support programs represent a relatively minor part, about 10 percent, of total non-employment income. Ninety percent of non-employment income represents investment and retirement income, which is why we use that label. It is more informative that “non-employment income.” In Mesa and San Miguel Counties, however, the income support programs make up 25 and 30 percent, respectively, of the non-employment income. Retirees’ residential location decisions were especially important in Mesa and Montrose Counties. These counties are classified as ‘Retirement Destination’ counties by the US Department of Agriculture because the number of residents 60 and older grew by 15 percent or more between 1990 and 2000.<sup>21</sup>

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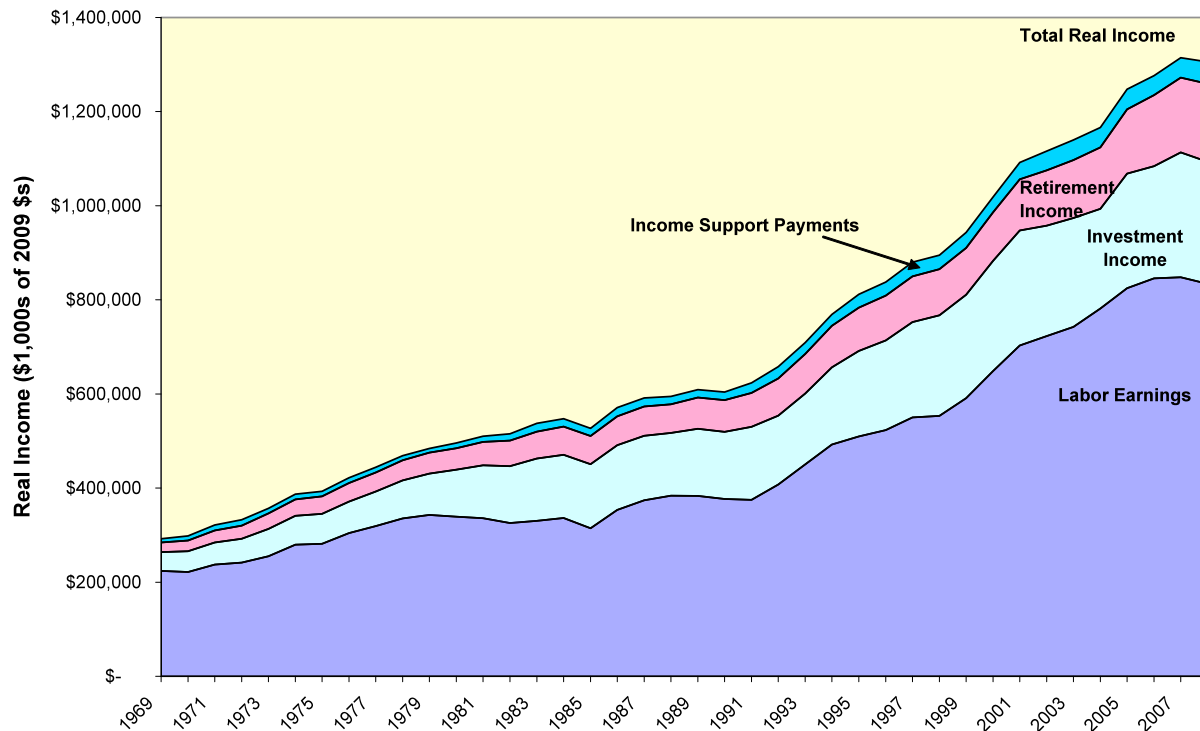
<sup>20</sup> It is important to note that some of the “rent” included in investment income is not an actual cash flow. It represents the value of the housing services provided to those who own their own homes. In addition, a significant part of investment income is not spent locally; it is simply reinvested to support asset accumulation and spending in the future, not the present although the resulting increased wealth does tend to support higher levels of expenditures.

<sup>21</sup> Delta, Ouray, Dolores, and Montezuma Counties were also Retirement Destination Counties. Economic Research Service, County Typology, U.S. Department of Agriculture.

This growth in retirees impacts not only the level of spending in local businesses but also the level of investment in new housing. Between 1990 and 2000 the number of owner-occupied homes built after 1990 increased by almost 13,000 in the three-county study area. In 2000 39 percent of these “new” homes were occupied by residents over 55.<sup>22</sup>

**Figure 16**

**Employment and Non-Employment Income: Montrose County, CO**



## *ii. The Visitor Economy*

Most communities recognize the importance of visitor spending in creating local jobs and income. Sometimes simply labeled “tourism,” usually meaning a sightseer, “visitors” are more diverse than that. “Visitors” include a broad variety of temporary residents including “sightseers” but also including people engaged in a variety of cultural and recreation pursuits as well as people attending business and professional conventions. It also includes second or seasonal homeowners and homebuilders. Colleges and universities also draw relatively longer term “visitors” in the form of students who usually bring an income source with them.

<sup>22</sup> 2000 Census Table HCT-5, Tenure by Age of Householder by Year Structure, Summary File 3.

Dean Runyan Associates working for the Colorado Tourism Office<sup>23</sup> has tracked the economic impacts of the Colorado travel industry on the state as a whole but also on smaller regions and individual counties. For our three-county study area, visitors were directly responsible for over five thousand jobs as a result of visitor expenditures of almost a half billion dollars. See Table 3.

**Table 3**

<b>The Economic Impacts of Overnight Visitors on the Colorado Economy</b>					
Direct Overnight Travel Impacts 2009					
County	Spending (\$millions)	Earnings (\$millions)	Jobs	Local Tax Revenues (\$millions)	State Tax Revenues (\$millions)
Mesa	\$241.9	\$66.8	3,030	\$6.8	\$5.7
Montrose	\$111.6	\$27.2	980	\$1.8	\$2.2
San Miguel	\$122.5	\$40.5	1,170	\$4.6	\$2.9
<b>Total</b>	<b>\$476.0</b>	<b>\$134.5</b>	<b>5,180</b>	<b>\$13.2</b>	<b>\$10.8</b>

"The Economic Impact of Travel on Colorado 1996-2009p",  
Dean Runyan Associates for Colorado Tourist Office, June 2010.

The economic impact of visitors includes the economic impact of those part-time residents who own or rent vacation homes. In the west end of our San Miguel County, the Gladel-Egnar area, about 15 percent of housing units is seasonal homes. In the Gateway area of southwest Mesa County about 5 percent of homes are seasonal. In the West End of Montrose County only about 3 percent of homes are seasonal. For the counties as a whole, over a third of the housing units in San Miguel County, the home of the Telluride resort, are seasonal. In Montrose and Mesa Counties, only about one percent of the homes are seasonal.<sup>24</sup>

### *iii. Trade Center Activities*

One group of "visitors" comes to urban areas to take advantage of the broader array of commercial businesses and non-commercial organizations that are found in urban centers. Usually, the larger the city, the broader the range of specialized businesses found there. Medical clinics, hospitals and medical centers, for instance can draw people from a relative broad geographical region depending on the level of expertise and specialization found there. Larger cities have a broader array of stores selling consumer durables, clothing, recreational equipment etc. They also have a broader array of restaurants, nightclubs, and entertainment venues. The same is true for legal, financial, accounting, and other professional services. As a result of this specialization, larger urban centers tend to serve a much broader geographic area than just the residents of the city or county in which those trade centers are located. This brings a flow of revenue into the urban area from outside, supporting local jobs and income.

<sup>23</sup> *The Economic Impact of Travel on Colorado 1996-2009p*, June 2010.

<sup>24</sup> 2000 Census, Summary File 1, table H5, Vacancy Status, and H1, Housing Units.

### *A Broader View of the “Local Economic Base”*

The Colorado State Demography Office regularly analyzes the economic base of each county in the state.<sup>25</sup> It begins its analysis with the “traditional economic base,” as we have done above, including in it agriculture, mineral extraction, manufacturing, and part of state and federal government. Although the amount of government the Demography Office includes in its definition of the “traditional economic base” is more expansive than the one we have used, the Demography Office finds that, in terms of jobs, only about a quarter of the actual economic base in Montrose and Mesa Counties is associated with those historical export activities.<sup>26</sup> For San Miguel County, because of the dominant role of the visitor economy around Telluride, the traditional economic base makes up only 8 percent of the actual basic employment with the visitor economy making up 65 percent of San Miguel County basic employment. Not surprisingly, the Economic Research Service of the U.S. Department of Agriculture categorizes San Miguel County as a “Recreation County,” meaning that commercial recreation infrastructure, employment, and income represent a significant part of the overall economy.<sup>27</sup>

The economic base approach taken by these Colorado state economists also identifies the part of the economic base associated with trade center activities, the visitor economy, and the spending supported by non-employment income (retirement, investment, and income support programs). The impact of those who commute in or out of counties to work is also included. Those commuting into another county to work bring back income to their county of residence while reducing the income available to be spent in the county in which they work.

Measured in terms of jobs, regional trade center activities and the flow of non-employment income were each about as important as the traditional economic base in Montrose and Mesa Counties: Each contributed about a quarter of the total basic jobs. The visitor economy contributed another 10 percent and local activities supplying materials and services to these basic sectors contributed about a sixth of the basic jobs. These “basic” jobs represented about 60 percent of all jobs in Montrose and Mesa Counties. The purely locally oriented jobs that focused on supplying services to local residents made up the remaining 40 percent of jobs.

In San Miguel County, where the visitor economy dominates the local economic base in terms of jobs, the traditional economic base, the regional trade center activities, and the role of non-employment income were much less important, together totaling 15 percent rather

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<sup>25</sup> [http://www.dola.colorado.gov/demog\\_webapps/economic\\_base\\_analysis](http://www.dola.colorado.gov/demog_webapps/economic_base_analysis) Accessed November 2, 2010. For documentation of this Colorado approach see: <https://dola.colorado.gov/dlg/demog/leifadocumentation.html> .

<sup>26</sup> This website information is provided in terms of employment rather than earnings or income. Since mineral extraction, manufacturing, and government jobs tend to pay above average wages, the impact of those jobs on spending within the local economy will be higher than the number of jobs indicates. For agricultural jobs, the difference between jobs and earnings varies from year to year. Hired farm workers get paid below average wages but in years of high agricultural prices farm proprietors can earn very high incomes; in poor years farm proprietors and total farm earnings can be negative.

<sup>27</sup> County Typology Codes, <http://www.ers.usda.gov/Data/TypologyCodes/> .

than about 75 percent of basic jobs as was the case in Montrose and Mesa Counties. The visitor economy largely dominates the entire San Miguel County economy. See Table 4.<sup>28</sup>

**Table 4**

2008 County Economic Bases: Employment						
Sectors of the County Economy	Montrose County		Mesa County		San Miguel County	
	Employment	% of Econ. Base	Employment	% of Econ. Base	Employment	% of Econ. Base
Traditional Economic Base: Agriculture, Mineral, Manufacture, & Government	3,079	24%	12,858	25%	417	8%
Regional Trade Center Activities: Medical, Educational, Retail, Services, etc.	3,306	26%	12,670	25%	312	6%
Visitor Economy: Tourism, Recreation, etc.	1,392	11%	4,050	8%	3,459	65%
Retirement, Investment, Income Support and Commuter Income	2,969	23%	11,870	23%	77	1%
Activities Supplying Goods and Services to the Economic Base	2,013	16%	9,366	18%	1,069	20%
Total Economic Base Employment	12,759	100%	50,814	100%	5,334	100%
Employment Associated with Local Residential Spending (Non-Basic)	8,355		30,221		1,598	
Total Employment	21,114		81,035		6,932	
Ratio: Total Employment to Basic Employment	1.65		1.59		1.30	

Source: [http://www.dola.colorado.gov/demog\\_webapps/economic\\_base\\_analysis](http://www.dola.colorado.gov/demog_webapps/economic_base_analysis) accessed 11-2-2010; adjusted by author.

This analysis underlines several important aspects of the economies of these three Uravan Mineral Belt counties: Even from an export base or economic base point of view

- It is important to look beyond mining, agriculture and manufacturing to understand the sources of jobs and income. While mineral extraction (mostly oil and gas production currently) represents seven percent of the three-county area economic base and provides 4,600 jobs directly, the trade center role of the urban health care and educational institutions are responsible for almost twice that number of jobs. The same is true of the visitor industry as well as the expenditures of retirees. See Table 5 below.
- The visitor economy is obviously an important part of the local economic base providing almost 9,000 jobs in the three-county study area;
- The income associated with retirees is an important source of jobs and income, larger than agriculture, mineral extraction or other elements of the traditional economic base. More broadly, the impact of the expenditures of all non-employment income rivals the impact of the entire traditional economic base in terms of job creation, amounting to 91 percent of the employment associated with the traditional economic base .
- The large urban centers serve a much broader geographic area, generating jobs and income because of those trade center activities. The size of this trade center impact on employment is almost the same as the employment impact of the entire traditional economic base.

<sup>28</sup> Because the various job totals in the summary reports from the Colorado Demography website did not exactly match the sum of the jobs in different categories, this table was adjusted so that the totals and the individual job counts were consistent. Also, job categories were relabeled to make them clearer.



Table 5

<b>The Economic Base of the Three-County Study Area: Employment</b>		
<b>Sources of Jobs</b>	<b>Three County Study Area Employment</b>	<b>% of Economy</b>
<b>Traditional Economic Base</b>	16,354	24%
Agribusiness	4,585	7%
Mineral Extraction	4,643	7%
Manufacturing	3,507	5%
Government	3,619	5%
<b>Regional Trade Center Impacts</b>	16,288	24%
Construction	3,385	5%
Communications	519	1%
Trade and Transportation	2,439	4%
Professional and Business Services	1,274	2%
Finance, Insurance and Real Estate	470	1%
Education and Health Services	8,201	12%
<b>Visitor Economy: Tourism, Recreation, Visitors</b>	8,901	13%
<b>Households Spending Non-Labor Income</b>	14,916	22%
Commuters' income	886	1%
Retirees' income	7,737	11%
Public Assistance Income	2,995	4%
Investment Income (Dividends, Interest, Rent)	3,298	5%
<b>Indirect Basic Jobs (supplying Basic Industries)</b>	12,448	18%
<b>Total Basic Jobs</b>	68,907	100%
<b>Non-Basic Jobs: Local Residential Services</b>	40,174	
<b>All Jobs</b>	109,081	

[http://www.dola.colorado.gov/demog\\_webapps/economic\\_base\\_analysis](http://www.dola.colorado.gov/demog_webapps/economic_base_analysis)

It should be noted that these conclusions reinforce our earlier analysis of the sources of additional income and jobs between 1990 and 2008. That historical review underlined the limited role of the traditional economic base as a source of new jobs and income, the importance of the expansion of the service sectors, and increasing role of retirement and investment income.

In evaluating the impact of the proposed uranium mill and associated mines on the economies of these three counties it is important to keep in mind this more complete picture of the economic base. The expansion of the uranium industry in this region will add to what has been a volatile but declining sector of the traditional economic base. To the extent that an expanded uranium industry is perceived to be an environmental threat to the surrounding area, it could have a negative impact on several of the primary sources of local economic vitality: the “footloose” income associated with retirees and in-migrating new residents, the income brought into the region by tourists, recreationists and other visitors, and the trade center activities associated with the regions growing urban centers. We will discuss further the economic impact both of the volatility of the mining industry as well as the potential stigma attached to uranium mining and milling later in this report.

## ***Thinking Analytically about the Local Economy and Local Economic Well Being: The Limits of the “Export Base” View of the Local Economy***

The export base or economic base view of the local economy is one of the most widely shared pieces of popular economic understanding. Most of us learned this way of understanding our local economies from our parents, grandparents, elementary school teachers, and neighbors. We were informally taught “tales of livelihoods” that explained to us how our families several generations back came to inhabit areas and made livings for themselves. That *popular* or *folk economics* tends to stick with us just as other cultural values and traditions do. It simply becomes part of the way we look at the world.

The traditional economic base of an area is usually associated with folk tales of how European-Americans came to inhabit any particular area and built a successful and thriving economy. This view is called an export base view because it focuses on the economic activities in which the local population specializes, producing more than it needs for its own consumption, and exports the surplus to the rest of the national or international economy. Those exports are seen as bringing money into the local economy from outside. That money then can circulate within the local economy putting people to work in locally-oriented economic activities and to import vital goods and services that could not easily or economically be produced locally. Unless the local residents want to live a self-sufficient non-monetary, subsistence way of life, those exports and the resulting income flows into the economy from outside sources are necessary for a modern, vital economy. In that sense those export-oriented activities are the region’s *economic base*: the economic energy driving the local economy.

Most regions have an export-oriented folk story: In Colorado it is mining, ranching, and other agricultural activities. In Arizona it is “cattle, cotton, and copper.” It is automobiles in Detroit, dairy farms in Wisconsin, corn in Iowa, wheat and cattle on the Great Plains, timber and hydroelectric power in the Pacific Northwest, coal in Appalachia, etc.

No widely held popular understanding of this sort could have become established and persisted for so long unless it had an important element of truth to it. In the context of the European-American settlement of a continent depopulated of its indigenous population by disease and warfare, the export base view was largely accurate in depicting how settlers were able to move from subsistence homesteads on a wilderness frontier to a prosperous commercial economy. Whatever its historical accuracy, however, it is important to ask whether that original 19<sup>th</sup> and early 20<sup>th</sup> century economic insight is a sufficient guide for understanding a modern 21<sup>st</sup> century economy. As we will explain below that the export base view of the local economy, even as broadened in the discussion of the economic base above, is now seriously incomplete and needs to be supplemented in several ways that allow us to accurately look at the *total* economy and all the sources of local economic well being when making public economic policy decisions.

### *Completing Our Analytical View of the Local Economy: The Total Economy*

As we will develop in more detail below, there are three important other economic insights that have to be integrated with the export base view to complete our view of the local economy:

- i. The export base view focuses only on what creates a local demand for workers. In that sense it ignores the other half of the twin supply-demand blades of the “economic scissors,” the important role of the local supply of labor in encouraging the expansion of local economic activity.
- ii. The export base view focuses only on commercial goods and services sold in markets in exchange for money. It ignores non-commercial, non-market sources of scarce and valuable goods and services that support and facilitate commercial activities and contribute to local economic well being.
- iii. The export base view, as the name makes clear, focuses on exports as the sole determinant of local economic vitality. Its message is that “only exports matter.” We need to understand that locally-oriented economic activity is not a passive, unimportant or “secondary” aspect of the local economy. By capturing, holding, and re-circulating income that comes into the local economy, the web of locally-oriented economic activities creates the “multiplier” impacts associated with exports and other income injected into the local economy.

#### *i. Incorporating Labor Supply into Our View of the Local Economy*

The export base view focuses on the commercial forces that draw workers and population to a particular area. What are the export-oriented activities the local area can support and thus create a local demand for workers? In a frontier economy these are likely to be land-based economic activities, hence the focus on ranching, farming, mineral extraction, and forest products.

That narrative has a compelling historical ring to it. But most economic activities in the 21<sup>st</sup> century are not land-based. The total of all jobs in agriculture, mineral extraction, and forest products represents only about 3 percent of total jobs in the American economy in 2008.<sup>29</sup> Clearly we cannot explain the location of economic activity across the American landscape on the basis of this tiny part of the total economy. We have to be able to explain why non-land-based economic activity locates where it does independent of this land-based tiny sliver of the overall economy.

Even if we stick with a focus on export-oriented economic activities as the engine driving a local economy, we are still left with the question of why a particular export-oriented firm chose to locate where it did. If we cannot explain that, we have not really

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<sup>29</sup> Agriculture, agricultural services, fishing, forestry, mining (including oil and gas), wood products, paper, and primary metals. U.S. Department of Commerce, BEA, REIS data base.  
<http://www.bea.gov/regional/spi/default.cfm?selTable=SA25N&selSeries=NAICS>

explained what the economic forces are supporting the local economy. For instance, much of light manufacturing (computer assembly, chip manufacturing, appliance manufacturing, etc.) as well as export-oriented services (publishers, information businesses, financial services, technical support, professional services, etc.) are relatively “foot-loose” in terms of where they locate. The fertility of the land, minerals in the ground, commercially valuable natural vegetation including livestock forage and timber are unlikely to provide an explanation for why most of the firms found in the Montrose or Grand Junction or Telluride areas chose to locate there. For that reason, the export base view of the economy provides only limited insight into the local sources of economic vitality.

Businesses locate in particular areas for a wide variety of reasons, but two considerations are almost always important: i. the availability of a sufficiently skilled workforce at an affordable cost, and ii. access at an affordable cost to the markets for the firm’s products. The geographic distribution of the population and people’s preferences for where they would like to live influence both of these important economic considerations. Businesses cannot afford to ignore either of these: markets and the cost of reaching them and an adequate labor supply at a reasonable cost are central to any business location decision.

The export base view of the world implicitly assumes that people do not care where they live. People are assumed to passively go to where the jobs are because they have no choice if they want to be employed and their families to prosper. But in the 21<sup>st</sup> century continental-wide American economy, individuals and families do have a choice as to where they live. They face a broad range of economic opportunities mixed with an equally broad range of regions and communities that have diverse sets of attractive and unattractive characteristics that are unrelated to job availability and pay. Individuals and families can make tradeoffs and choices that mix labor market opportunities and the level of pay with other local characteristics such as quality of schools, crime rates, levels of congestion and commuting time, intensity of social conflict, pace of life, neighborliness, cultural variety, recreation and cultural opportunities, etc.

Areas that have mixes of qualities that make it easy for those areas to attract and hold residents will have a relatively large, diverse, and skilled workforce available at a somewhat lower price. Alternatively, such areas can get workers to move to the area without wages being bid up significantly. That makes such areas attractive to businesses. The fact that businesses are run by people who also have preferences about where they and their families live only adds to the economic importance of a community’s attractive qualities. To the extent the dynamic between the attractiveness of a community to new residents and businesses has triggered ongoing economic development, local markets for goods and services will also be expanding, increasing the economic attractiveness of the area to firms.

In brief, labor supply and its cost and the location of population concentrations matter to businesses. Areas that attract high quality workers at a relatively low price will, in turn, be attractive to business firms. Ignoring labor supply and focusing only on labor

demand, as the export base view does, is inappropriate economic analysis. As in most components of a market economy, both supply and demand matter.

It is important to keep in mind that conceptually, we do not have to choose between the export base view of the economy and the residential location choice view. These two views encompass between the two of them the two primary market forces of supply and demand. We should be careful to consider both. The relative importance of labor supply and labor demand can be expected to shift over time and vary across geographic areas. At any particular location at a given time, the relative importance of these two sets of forces is an empirical matter. Local economic development policy, however, may choose to focus strategically on some elements of one or both of these sets of economic forces.

All three of our study area counties have seen significant population growth primarily supported by the net in-migration of new residents. Between 1990 and 2009 net in-migration added about 50 percent to each of these counties' populations. For Montrose and Mesa Counties more than 80 percent of the growth was due to net in-migration. For San Miguel over 60 percent of population growth was the result of net in-migration. About 70,000 new residents moved into the region during this time period.

*ii. Looking at **All** Sources of Economic Value Including Non-Market Economic Values*

The economic dynamic described above has been called *amenity-supported local economic development*. This economic potential in some ways is the opposite of the economic force that the export base view of the economy emphasizes. Within the export base view, people move to where the jobs are. Within the amenity-supported economic development model, economic activity follows the residential preferences of the population. Economic activity shifts in this way because the existence of local amenities provides businesses with access to a lower cost skilled labor force and to markets for their goods and services. In essence, because workers and families value local amenities, they are willing to sacrifice a certain amount of income to gain access to those site-specific qualities. They accept lower wages than they could earn in less attractive locations as an effective "price of admission" to what potential residents judge to be a more valuable set of local qualities. The *total real income* being received by residents comes in two parts: The value of the conventional paycheck and the value of the site specific amenities to which living in that location provides access. The value of those local amenities provides residents with a "second paycheck."<sup>30</sup>

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<sup>30</sup>Ed Whitelaw at the University of Oregon and with ECONorthwest coined that phrase. Local economies can be a bit more complicated than this. As the local economy expands, limited supplies of land for commercial and residential development can lead to land values rising, increasing both the cost of living and the cost of doing business. This can ultimately work to stabilize community size, limiting that location to those for whom it is the most productive site for a business and to those residents who most highly value the qualities of that location. The higher cost of living will reduce the purchasing power of local wages and residents will pay an effective access fee in the form of lower real (cost of living adjusted) wages. To the extent that the available land base is not a serious constrain on ongoing development, the

This is not a new way of looking at the local economy. Since the mid-1950s economists have emphasized the importance of residential location decisions as a powerful economic force. They focused on the role of local environmental “amenities” such as climate and natural landscapes in the settlement of the desert Southwest (including Arizona, New Mexico, and Southern California), Florida, and the Pacific Northwest.<sup>31</sup> Tiebout underlined the fact that people “shop around” for the social amenities produced by different levels of local government taxation and different public spending patterns such as on schools, parks, and roads.<sup>32</sup> Borts and Stein argued that in a mobile, open economy, it would be an area’s ability to attract and hold a labor force without bidding up labor costs that would determine the geographic distribution of economic activity.<sup>33</sup> More recently the rapid growth along Colorado’s Front Range, the explosive growth within many small Rocky Mountain communities as well as the growth in the cities on the West Slope has provided another manifestation of amenity-supported local economic vitality.

But these economic forces tied to local amenities have transformed many parts of the nation’s economic geography and help to explain the above average economic performance across most of the Mountain West, not just in Colorado, as well as in the Southeast and the Pacific Northwest over the last two decades before the Great Recession struck.<sup>34</sup> Ten years ago the Economic Research Service of the U.S. Department of Agriculture published a special edition of ***Rural Development Perspectives*** on the rapid growth in population in the rural counties of the Mountain West. That growth attracted attention of analysts because it could not be explained by the Mountain West’s traditional land-based activities of farming, ranching, forest products, and mineral extraction, all of which were in relative or absolute decline. These USDA studies were focused on the non-metropolitan West, where one would expect these traditional land-based economic activities would dominate. The titles of the studies indicated the common theme: “Amenities Increasingly Draw People to the Rural West,” “Quality of Life, Nontraditional Income and Economic Growth: New Development Opportunities for the Rural West,” “Wildlife Conservation and Economic Development in the West,” and “Jobs Follow People in the Rocky Mountain West.”<sup>35</sup>

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effective price residents pay to gain access to the qualities associated with that location are likely to be reflected in the lower pay they accept compared to what they could earn in less attractive locations.

<sup>31</sup> Ullman, Edward, 1954, “Amenities As a Factor in Regional Growth, ***Geographic Review***, 44(1):119-132.

<sup>32</sup> Tiebout, Charles, 1956, “A Pure Theory of Local Expenditures, ***Journal of Political Economy***, 64(2):160-164.

<sup>33</sup> Borts, G.H., and J.L. Stein, 1964, ***Economic Growth in a Free Market***, New York: Columbia University Press

<sup>34</sup> Thomas M. Power and Richard Barrett, ***Post Cowboy Economics: Pay and Prosperity in the New American West***, Island Press, Spring 2000; Power, Thomas M., 1995, editor, “Economic Well-Being and Environmental Protection in the Pacific Northwest: A Consensus Report by Pacific Northwest Economists”, Department of Economics, University of Montana, Missoula, MT, December.

<sup>35</sup> See the special issue of ***Rural Development Perspectives*** on the rural West, 14(2), August 1999, USDA, Economic Research Service.

This half-century of economic research simply underlines the important role that non-commercial, non-market goods and services can play both in contributing to the economic well-being of individuals and households as well as the economic vitality of communities. Some of these non-market economic values are human created, others are gifts of nature, flowing as they do from well functioning natural systems. All of them are often encompassed in the larger concept of “quality of life” or “local amenities.”

### *iii. Capturing, Holding, and Circulating Income in the Local Economy*

We return to a discussion of how the modeling of the local economic impacts has to move beyond an “only exports matter” point of view. Most economic impact modeling, including that done on the proposed Piñon Ridge uranium mill and associated mines, implicitly takes that point of view, effectively dismissing the bulk of local economic activity as “secondary” or “passive.” This is an important error. Earlier in this report we pointed out the failure of a traditional export base modeling approach to explain the actual economic vitality of the Colorado Uravan Mineral Belt counties. Here we focus on the important economic role of locally-oriented economic activity in boosting the local economy.

Exports by themselves do not create a local economy. On the North Slope of Alaska billions of dollars worth of oil have been produced but there is almost no “local economy” on the North Slope. The value of that oil and the wages earned producing it all flow to other areas a great distance from the North Slope where people actually live and where there is the commercial infrastructure in which that income can be spent. This is an extreme example, but the mining, timber, cattle, and farm towns that grew up around a primary export often had similar limiting characteristics: the income generated by the exports primarily went to fund imports. That is, the income from the exports almost immediately “leaked out” of the region. That is why many of the mining and mill towns became the equivalent of ghost towns as demand for the exports declined or technological change reduced the size of the workforce needed to produce the exports. Empirical economic analysis of the impact of natural resource activities in rural areas confirms that the multiplier impacts associated with natural resource extraction activities in contemporary rural areas can also be nearly zero.<sup>36</sup> This is likely to be the case also in the rural west ends of our three Colorado Uravan Mineral Belt counties.

The actual size of the impact of an export activity on the local economy is determined by the interaction of two sets of local economic characteristics: The size of the flow of income into the local economy from the outside and the web of local economic interconnections among residents that captures and circulates that income among businesses and households. The “multiplier” impacts associated with export income is determined by that ability to capture and circulate income locally. It is the local web of specialized and interdependent businesses and households that actually make up the

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<sup>36</sup> “A Test of the Economic Base Hypothesis in the Small Forest Communities of Southeast Alaska,” Guy C. Robertson, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, General Technical Report, PNW-GTR-592, December 2003.  
[http://www.fs.fed.us/pnw/pubs/pnw\\_gtr592.pdf](http://www.fs.fed.us/pnw/pubs/pnw_gtr592.pdf)

local economy. Without those locally-oriented businesses there can be enormous export flows but only a primitive local economy.

Both export-oriented and locally-oriented businesses contribute to the vitality of the local economy. It can be a serious economic error to ignore either of these two sides of the local economy.

As pointed out above, much of the west ends of our three county study area are only very lightly settled with little or no economic infrastructure to capture and hold the dollars the proposed uranium mill and associated mines may generate. With the exception of Nucla and Naturita, almost all of that income and many of the jobs will flow to more distant trade centers, primarily Grand Junction. Even Nucla and Naturita, which together have about 1,400 residents, do not meet the conventional definition for an urban area (greater than 2,000 residents) and are classified as part of an entirely rural area. That, of course, is part of the attraction of small town America, but that rural character also assures that most of the economic impact associated with the proposed uranium production will be felt elsewhere. That will comfort those who do not look for economic change but discourage those looking for sustained economic development to flow from a renewed uranium industry.

#### *Conclusions on the Limits of the Export Base View of the Local Economy*

The importance of amenity supported local economic vitality in transforming Colorado's economic geography as well as that of much of the United States cannot be safely ignored when evaluating the likely economic impacts of the proposed Piñon Ridge uranium project. Local economic vitality and local economic well being are not primarily determined by those land-based economic activities that facilitated the original European American settlement of the West Slope in earlier centuries. Although those traditional economic activities remain significant to local economies, they have not been the source of new jobs and income for the region. The economic impacts of the proposed uranium mining and milling operations need to be put into a long-run economic development context: What are these uranium activities likely to contribute to the sustained economic development of the region?

In answering that question, the importance of the attractiveness of a region to new residents and businesses has to be considered along side any particular proposal to boost the region's exports. To the extent that a re-industrializing of the region around the production of radioactive materials damages the region's attractiveness as a place to live, work, raise a family, and do business, it may undermine future economic vitality rather than stimulate it. To the extent that those mineral extraction activities are also unstable, generating booms and busts that weaken communities and economies rather than strengthen them, there is even more reason to be concerned about what that revival of a uranium industry in the region can actually contribute to local economic vitality and well being.



In the following sections we turn to a discussion of those potential negative economic impacts associated with a revival of the uranium industry in our three-county study area. Here we simply wish to point out the part of basic employment that may be at risk to any deterioration in the qualities of this three-county region that has supported not only a significant visitor economy but also have supported the ongoing in-migration of working age families as well as retirees. This in-migration boosts the regional population, making feasible a much broader range of businesses that can help capture, hold, and circulate the income that flows into the region. Those income flows include the “footloose” investment and retirement income as well as the spending by tourists, recreationists, as well as visitors taking advantage of the broader array of medical and other professional services, entertainment and cultural institutions, and other trade center businesses.

As discussed above, the visitor economy is responsible for 13 percent of basic employment in our three-county study area. The inflow of retirement and investment income as well as the income brought back into the area by those who commute out to work are responsible for 22 percent of basic jobs. The continued inflow of that “footloose” income could also be put at risk by a perceived deterioration of quality of life in the region. Some of the regional trade center activity is also tied to the region’s ability to attract new, working age, in-migrants. Post-secondary education schools that draw students from a larger region are part of that. Amenity-migrants to the surrounding area both created the demand for what trade centers can provide while also providing the technical and professional workers who support trade center service businesses. If a third of the trade center impacts can be attributed to amenity migrants, that employment contribution would be about 7 percent. Finally, the indirect basic jobs that support these amenity-sensitive elements of the regional economy have to be included. They represent another 10 percent of the total basic sector jobs. In total these amenity-sensitive basic job sectors represent 52 percent of all basic employment in the three-county area. See Table 6 below.

**Table 6**

<b>Basic Employment Jobs Sensitive to Local Amenities Tri-County Study Area: Mesa, Montrose, and San Miguel</b>		
<b>Economic Sector</b>	<b>Basic Jobs</b>	<b>% of Basic Jobs</b>
Visitor Economy	8,901	13%
Non-Employment Income	14,916	22%
One-third Regional Trade Center	5,429	8%
Share of Indirect Basic	6,448	9%
<b>Total Amenity-Sensitive Basic Jobs</b>	<b>35,695</b>	<b>52%</b>

#### **4. Economic Modeling of the Local Impacts of the Proposed Uranium Mill**

One set of the socioeconomic impacts of the proposed uranium mill and associated mines that is of considerable interest to residents, businesses, and governments is the conventional economic impacts: number of jobs, level of new income, and total business spending that is likely to be brought to the local economy. Both the Energy Fuels socioeconomic study and the study commissioned by Montrose County used the IMPLAN economic model to estimate those economic impacts. In this section we will present our own IMPLAN modeling of those impacts and compare them to these two previous studies.

But first it is important to decide what we mean by the “local” economy that is being impacted. Depending on how the geographic area that is being studied is defined, quite different impacts can be legitimately calculated. In general, the larger the geographic area being considered, the more likely it is that the needs of new business activity and the needs of the new workers and their families can be met within that economy. The smaller the geographic area being studied, the more likely it is that businesses and households will have to go outside the area to make many of their purchases and the smaller the “ripple” or “multiplier” impacts will be in the local area because the spending that is stimulated “leaks” out of the area. On the other hand, a larger geographic area is likely to have a larger economy, especially if that larger area contains a substantial trade center. So, although the additional job and income impact are larger, so is the size of the overall economy and the relative, *percentage* impact could actually be smaller.

Thus as we go from a small, rural town to a larger contiguous area that includes an urban trade center to an entire state to the entire nation, the total impact of a change in economic activity will grow larger as more and more of the total change in economic activity is captured within the larger geographic area economy being studied. But the percentage impact and relative importance of those changes to that much larger economy may shrink. Accurate impact analysis may find the indirect and induced impacts of an economic change to be quite small in a lightly settled rural area while finding them to be considerably larger at the regional or state level.

In our analysis we assume the primary focus of the socioeconomic analysis should be on the likely economic impacts within the West End of Montrose County where the proposed mill will be located. We discuss the reasons for focusing on just part of Montrose County below.

##### ***The Appropriate Economy to Model to Understand the Local Economic Impact of the Proposed Uranium Mill and Mines***

Both the Energy Fuels and Montrose County socioeconomic impact analyses chose to use Montrose County as the economic area for which the economic impacts associated

with the proposed Piñon Ridge uranium mill and associated mines should be calculated. Although that might appear to be appropriate given that the mill would be built in Montrose County and some of the uranium mining might take place there, using Montrose County as the economic focus ignores geographic and economic reality.

As the Energy Fuels socioeconomic analysis states:

The Uncompahgre Plateau runs northwest to southeast through the central part of [Montrose] county. This geological feature divides the County into the Uncompahgre/Gunnison River basins on the east and the Dolores/San Miguel River basins on the west. (p. 3)

The Montrose County socioeconomic analysis spells out the economic consequences of this geographic divide: The West End of Montrose County where the proposed mill would be built is reachable from the City of Montrose and the more densely settled eastern part of Montrose County only by a circuitous route “of 85 miles, which passes through two neighboring counties” to the south, Ouray and San Miguel, before swinging back north to the Naturita-Nucla area of the Montrose County West End. As the study put it:

“...[U]nder current circumstances, many of the residents of the West End travel outside of [Montrose] County (mostly to Grand Junction) for many of their retail purchases. It is estimated that this represents a significant portion of these resident’s expenditure potential lost to surrounding jurisdictions.” (p. 30)

The Montrose County study actually proposes the construction of a highway across the Uncompahgre Plateau at an estimated cost of \$100 million to provide a “more direct transportation link to eastern Montrose County” from the West End. (p.3) This would enhance “an expansion of commerce between Eastern Montrose County and the West End, i.e. in terms of an increased capture of the expenditure potential within the County from West End residents.” (p. 29)

Note the implicit acknowledgement at the end of this statement that with the current highway route between the east and west ends of Montrose County there would be limited impact of new economic activity, such as the proposed mill in the West End, on eastern Montrose County. In fact, most of the expenditure impact would be felt, instead, in the Grand Junction area in Mesa County. This is important to the economic modeling of the impact of the proposed mill in the West End on Montrose County. Given the barrier that the plateau currently represents to commerce between the West End and the Montrose city area, expenditures in the West End are unlikely to flow to businesses in the Montrose city area. Instead they are likely to flow out of Montrose County to neighboring counties in Colorado and Utah.

In fact, the Montrose County study points out that the Montrose city area would be “an unlikely option for West End employees” to live because of the commuting difficulties. In

fact, the study estimated that only one percent of the new jobs in the West End would be filled by residents of the City of Montrose. (pp. 36-37) The Energy Fuels analysis concludes that “the majority of indirect and induced spending associated with the construction of the Mill is likely to occur in other municipalities” that Naturita and Nucla “due to limited commercial and retail outlets” in the West End. Energy Fuels “analysis assumed that only 10 percent of indirect and induced spending would occur in each of these towns.” (p. 44)

“[T]he mill is expected to generate an additional 284 jobs through additional economic activity. These jobs would be generated at indirect businesses that support the mill (e.g. mining, trucking, vendors) and as a result of additional household spending (e.g. retail). It is uncertain where all these jobs would be located, but they would be spread among the small communities of western Montrose County and adjacent counties in Colorado and Utah.” (pp. 46-47)

“The employment situation with the miners and truck drives is more complicated. Energy Fuels’ Mine Operations Plan identified potential ore feed from Energy Fuels’ mines and mines operated by others over a six county area (Montrose, Mesa, and San Miguel in Colorado and San Juan, Grand, and Emery in Utah).” (p. 45)

Because of this, Energy Fuels concluded its socioeconomic analysis with the observation that: “This project is expected to create a broad, **regional** stimulus centered in western Montrose County, rather than a localized boom.” (p. 51, emphasis added).

Despite recognizing the fact that the mill and mine would be located in a rural area with little connection to the more densely settled east side of Montrose County, both the Energy Fuels and Montrose IMPLAN modeling used Montrose County as the economic area of analysis, implicitly including in that economy the city of Montrose and the rest of the east side of the county that taken together has a population almost 14 times that of the West End from which the eastern portion of Montrose County is economically and geographically separated.

Within the IMPLAN model of all of Montrose County, the diverse set of commercial businesses located in the greater Montrose City area on the east side is treated as a source that can provide the West End with the goods, services, and workers that business and households in the West End need to support new economic activity. But in reality, that is not the case since the West End is largely economically and geographically isolated from the large urban economy on the east side. The West End expenditures and economic impacts will be felt elsewhere, outside of Montrose County. That is the reason that the economic impact analysis should have focused on the rural West End and not the whole of Montrose County. If that had been done, the rapid leakage of most of the spending impacts out of the West End and out of Montrose County would have been recognized and lower and more realistic local economic impacts would have been calculated.

Instead these two socioeconomics studies project erroneously large impacts of the mill on the West End and Montrose County. The Montrose County study, for instance, projects a total of 516 to 649 jobs created in the West End by the mill and associated mining, depending on whether 50 or 100 percent of the uranium mining to support the mill takes place entirely within the West End of Montrose County. (Table 4, p. 21 and Tables 9 and 10, p.27)<sup>37</sup>

The Energy Fuels study is more conservative, recognizing that it is difficult to project where in a five county area the mining, ore hauling, indirect, and induced jobs will be located. It estimates that 315 total jobs will be created just by the operation of the mill in the West End of Montrose County. (Table 27, p. 46)

Our estimates of the total employment impact in the West End and Montrose County, as explained later in this section, is just 116 jobs, one-third to one-sixth of the other estimates. Our estimate takes into account the fact that initially none of the mining may take place in the West End but will be located instead in Mesa and San Miguel Counties in Colorado and Grand and San Juan Counties in Utah. It also recognizes that much of the impact of the spending associated with the operation of the mill will quickly leak out of this rural area because of its limited commercial infrastructure.

### ***The Residence of Mill and Mine Workers***

Energy Resources estimates that of the 85 jobs associated with the proposed uranium mill, 80 percent or about 65 of the jobs will be filled by “local hires.” This will be true, they say, because “Energy Fuels desires to hire local employees.” (p. 45) This suggests that rather than hiring the best workers out of the pool that apply for the jobs, Energy Fuels will discriminate in favor of local residents. Energy Fuels’ analysis indicates that it would focus its hiring on the unemployed workers available locally as well as local residents who currently commute out of the local area to work.<sup>38</sup> It is certain, however, that many very qualified non-local workers within commuting distance of the mill will also apply. It seems unlikely that Energy Fuels would want to limit its hires only to the narrow pool of local unemployed and existing out-commuting residents when a broader pool of skilled and experienced workers will be available. Energy Fuels does not expect the remaining 20 direct hires at the mill will initially live in the West End but does project that they will ultimately move there. We share Energy Fuels expectations that a significant portion of the employees will live outside of the West End. We, however, believe, that that pattern of commuting into the West End to work will continue over the life of the project. For these reasons, we conservatively assume that at least 20 of the workers will be in-commuters who do not live in the West End.

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<sup>37</sup> The Montrose County socioeconomic study assumed that the uranium mill and mining would not be fully operational until 2020, rejecting the Energy Fuels projection that operations would commence in 2012. (p. 20)

<sup>38</sup> Table 23, p. 39.

It should be noted that “local” in the Energy Fuels’ analysis includes not only residents of the West End of Montrose County but also residents of northern San Miguel County (Norwood area) and residents of eastern San Juan County, Utah, (La Sal area). (Table 23, p. 39) Energy Resources, however, expects 90 percent of the Energy Fuels mill employees will choose to make their residence in the West End. (p. 45). In contrast, Energy Fuels assumed that many of the 230 projected indirect and induced jobs would not be residents of the West End. Energy Fuels says that: “It is uncertain where all these jobs would be located, but they would be spread among the small communities of western Montrose County and adjacent counties in Colorado and Utah.” (pp. 46-47) In fact, many of them are likely to be located in Grand Junction, the primary trade center in the region, not in the small communities in surrounding rural area.

The Montrose County economic impact analysis includes the impact not only of the jobs at the mill but also the jobs associated with the mines that will supply the mill. The IMPLAN modeling was done assuming that the impact of all of the mill jobs and either half or all of the associated mining and ore hauling jobs would be captured in Montrose County. This led to a Montrose County employment impact of 199 to 313 direct jobs and 516 to 649 total jobs. The total job impact is so large because the analysis *assumed* that 50 to 100 percent of the mining and hauling jobs would be located in the West End or the miners and haulers would live in the West End *and assumed* that the indirect and induced jobs would also be largely located in the West End. Over 80 percent of all of the new jobs, between 420 and 520 jobs, are assumed to go to existing residents or to non-residents who then move to the West End to live. Less than 20 percent of the jobs are assumed to go to workers who continue to live outside of Montrose County. Given the rural nature of the West End and the limited ability of that rural economy to supply the needs of the mill, mining companies, and households, this is pure wishful thinking. Given that the initial Energy Fuels mines will be located in Mesa, San Juan, and Grand Counties in Colorado and Utah and that the mix of mines that will provide the long run supply of uranium ore will be spread over a five county areas in Colorado and Utah, there is absolutely no reason to assume that 50 percent of the miners will live in the West End, not to mention 100 percent.

Finally, it should be pointed out that mill and mine workers may purposely choose to live as some distance from the mill and mine. Given the volatile nature of the mining and milling activity and the environmental damage and/or stigma associated with the mining and milling of radioactive material, workers may want to reside some distance away to protect the value of their investment in their homes. Some businesses serving the mill and mines and their workers may choose to do the same.

### ***The Stability and Duration of the Jobs Associated with the Mills and Mines***

Energy Fuels’ socioeconomic analysis assumed without analysis or discussion that the proposed mill will operate continuously for 40 to 50 years and could possibly double its ore processing capacity in the future.<sup>39</sup> As the history of the uranium mills in the region documents, this is highly unlikely and would be unprecedented. As will be discussed

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<sup>39</sup> Ibid. p. 45.

later in this report, when uranium prices fall, the mill will cut back production or shut down completely. When uranium prices rise again, it will hire back workers. In addition, when uranium prices remain low for an extended period of time, the mill may be permanently closed and dismantled. This is not speculation. In recent years both the Cotter mill in Cañon City and the Denison mill outside of Blanding have ceased processing conventional uranium ore and laid off much of their workforce. The Cañon mill has been shutdown for several years and is now being dismantled. The Shootaring Canyon mill to the west of the Blanding mill in Utah is also currently in “standby” status. Historically none of the uranium mills have ever been operated continuously at full capacity for forty or fifty years. The proposed Piñon Ridge mill will not either.

In the socioeconomic analysis of the proposed uranium mill and its associated mines this instability in employment, income, and purchases from local businesses has to be taken into account to provide a realistic view of the benefits and costs of the proposed mill. Assuming stability in employment, income, spending, and production that is unlikely to be experienced does not provide an accurate picture of the jobs, income, and tax revenue impacts on the local area.

### ***Accurately Modeling the Impact of the Proposed Mill on the Rural West End of Montrose County***

Energy Fuels’ proposed Piñon Ridge mill would be built west of the towns of Nucla and Naturita in western Montrose County, Colorado. See Figure 15. The proposed Piñon Ridge mill would be the first new uranium mill built in the United States in 25 years. In this section we present the results of our economic modeling of the impacts of that proposed uranium mill as well as the impacts of an alternative: Remediation, reclamation, and closure of the many abandoned mines in western Montrose County.

#### ***Project Workforce and Population***

Energy Fuels expects that the Piñon Ridge mill will directly create 65 new jobs in the West End once it is processing 500 tons per day (tpd) of uranium-vanadium ore. That is Energy Fuel’s estimate of the number of local hires that they plan to employ in the uranium mill. Energy Fuels assumed that the 65 uranium mill jobs would be filled by residents already living in the West End, which includes the towns of Nucla and Naturita.<sup>40</sup> Energy Fuels anticipates that they will need to hire a total of 85 people to run the uranium mill but anticipates that 20 of the more specialized jobs will be filled from outside Montrose County and those employees may not live in the West End. Energy Fuels estimates that the employee compensation for the mill workers would be in the range of \$40,000-\$75,000 per year. Keeping within this range we chose to model the mill jobs at \$65,000 per year per employee<sup>41</sup>.

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<sup>40</sup> Elsewhere in this report, we will question this assumption but to be conservative, we used it in our modeling.

<sup>41</sup> In the Socioeconomic Baseline and Impact Analysis for the Proposed Piñon Ridge Uranium Mill report prepared for Energy Fuels by the Berger Group (November 2009) the pay range is given on page 45.

Uranium mills need uranium ore but the modeling of that employment becomes significantly more difficult because Energy Fuels does not have a permitted uranium mine in the same county as the Piñon Ridge mill and does not plan to rely on any given set of mines over the projected life of the mill. Energy Fuels notes, “The employment situation with the miners and truck drivers is more complicated.” We, like Energy Fuels, chose not to model the impact of the uranium mines or the truck drivers needed to haul the uranium ore to the mill because those mines are very likely to have a limited impact on the West End economy. As of June 2010, Energy Fuels owned two fully permitted uranium mines.<sup>42</sup> According to Energy Fuels’ mining plan, the two fully permitted mines could initially produce 64 percent the uranium that they annually plan to mill at Piñon Ridge<sup>43</sup>. In October 2010 Energy Fuels acquired a 641 acre uranium-vanadium lease in San Miguel County.<sup>44</sup> It also has numerous other leases throughout the seven-county, two-state region.

The problem with these mines as far as modeling is concerned is that neither mine is in the study area. The Energy Queen mine is just outside of La Sal, Utah in San Juan County and the Whirlwind mine is just south of Gateway, Colorado in Mesa County on the border with Grand County, UT. In addition, the location of the other 35 percent of the mining is unspecified and, according to Energy Fuels is likely to vary over time as new sources are developed and older sources abandoned. Even Energy Fuels’ Whirlwind and Energy Queen Mines do not have the capacity to support the proposed mill for more than a quarter of the claimed 40 year life of the mill. Because Energy Fuels’ initial primary supply mines are in other counties, it is unlikely that the most of the miners would live in or contribute substantively to the West End economy. The same is true for the truck drivers who would be hauling the ore to the mill. There are larger and closer (or at least similarly distanced) towns near each mine compared to Naturita or Nucla (e.g. Moab, Utah and Grand Junction, Colorado). Because of the proximity of Energy Fuel’s primary uranium mines to larger towns with far more developed local economies, we did not include the hauling or the mining of the uranium ore as part of the Montrose County West End economy.

### *Economy and Employment*

The economic impact of the Piñon Ridge mill was modeled using the input-output model IMPLAN (version 3). Because of the rural nature of the West End, isolated as it is from the city of Montrose, the impacts were modeled for a four zip code rural area instead of all of Montrose County. The zip codes that were modeled were 81411, 81422, 81424,

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<sup>42</sup> <http://www.energyfuels.com/news>

<sup>43</sup> In the Piñon Ridge Project Environmental Report prepared for EF by Edge Environmental (November 2009), it was asserted that at the 500 tpd production rate “most of the ore would be produced and delivered by mines owned by Energy Fuels” and that each of EF’s Whirlwind and Energy Queen mine “is capable of producing 200 tpd or more of uranium ore.” Page 2-3. At those outputs these two mines could provide 80 percent or more of the mill’s 500 tons per day design capacity but for only a 10-year period.

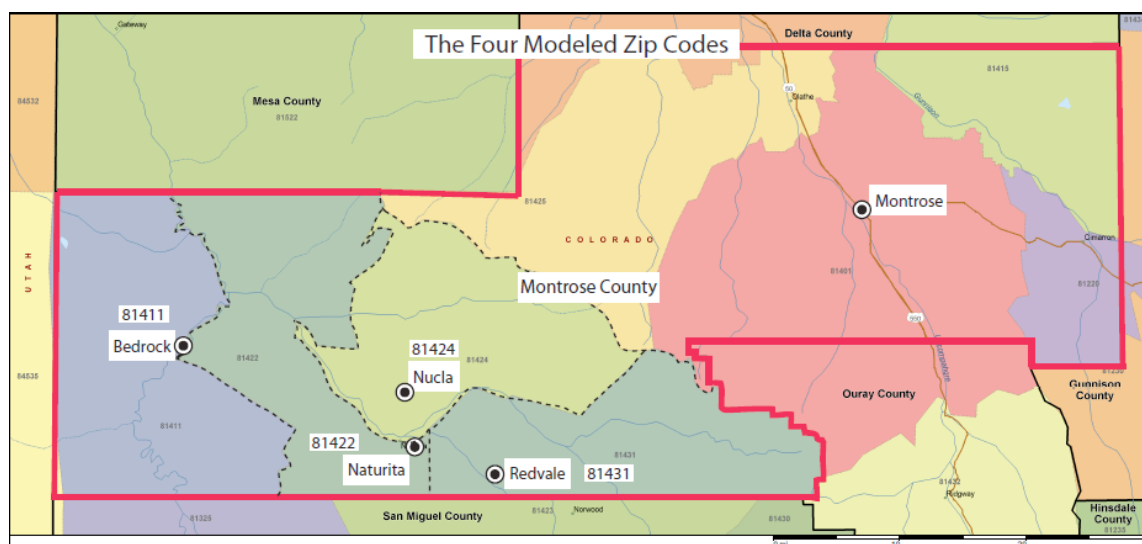
<sup>44</sup> [http://www.telluridewatch.com/view/full\\_story/10002092/article-Energy-Fuels-Acquires-San-Miguel-County-Uranium-Lease?instance=secondary\\_story\\_left\\_column](http://www.telluridewatch.com/view/full_story/10002092/article-Energy-Fuels-Acquires-San-Miguel-County-Uranium-Lease?instance=secondary_story_left_column)



and 81431. (See Figure 15.) Because we did not include the town of Montrose in the modeling, much of the indirect and induced benefits of the Piñon Ridge mill quickly leaks out of the modeled area due to its rural nature.

The economic impact of the proposed mill was modeled under Industry Code 125 “other basic inorganic chemical manufacturing” which is the sector that best represents uranium processing in IMPLAN.<sup>45</sup> The model was modified slightly to allow for the mill employment and employee compensation proposed by Energy Fuels. The results of the modeled milling can be seen in Table 7 where the direct, indirect, induced, and total effects can be seen on local employment, labor income, value added, and output or sales on an annual basis.

**Figure 15**



The modeled zip codes are outlined by the dashed lines in Figure 15.

<sup>45</sup> Energy Fuels’ economic modeling also uses IMPLAN and used the same industrial sector for the mill. It gives the North American Industrial Classification System number for the sector (150) rather than the IMPLAN Industry Code.

Table 7

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	65	\$5,756,319	\$10,306,680	\$50,189,544
Indirect Effect	37	\$3,199,825	\$8,080,188	\$13,090,667
Induced Effect	14	\$425,902	\$1,293,909	\$2,008,505
Total Effect	116	\$9,382,046	\$19,680,776	\$65,288,717

Using Energy Fuel's direct employment of 65 new resident jobs, the operation of the mill is anticipated to create an additional 51 jobs from indirect and induced effects in this rural area.<sup>46</sup> This can be compared to Energy Fuel's projection of 230 additional jobs. The uranium mill is expected to generate \$9.4 million in labor income and have an impact on total business sales of \$65 million each year that the mill is in operation. This can be compared to Energy Fuel's prediction of \$18.7 million in labor income and a total effect of \$140 million in additional business sales)<sup>47</sup>.

This discrepancy between our results and those of Energy Fuels' modeling can be accounted for by looking at the total area modeled. Energy Fuels chose to model all of Montrose County, which includes the city of Montrose. We chose to model the rural four zip code area of the West End of the county in which the mill will be located and some of the workers will be living. Because the city of Montrose is large compared to the West End, a model that includes the city of Montrose assumes that much more of the money generated in the West End by new economic activity would re-circulate in the form of indirect and induced jobs and income than the actual rural economy could actually support.

We feel that it is more accurate to model the effects of the uranium mill on the West End alone since it is not clear where the uranium mill workers will choose to spend their money. The greater Grand Junction area is almost five times larger than the Greater Montrose area<sup>48</sup> and it is only about a half hour farther away than the City of Montrose from Nucla or Naturita. Because of the range of amenities that Grand Junction can offer, it is unrealistic to assume that residents of the West End would travel to the city of

<sup>46</sup> We have focused on the longer term operations jobs once the mill is constructed. Construction jobs are short-run, one-time-only, jobs that usually draw on a mobile construction workforce of specialized workers. That brief surge of construction jobs does not contribute to sustained development.

<sup>47</sup> In the Socioeconomic Baseline and Impact Analysis for the Proposed Piñon Ridge Uranium Mill report prepared for Energy Fuels by the Berger Group (November 2009) table 27 gives the economic impacts from the operations of the mill.

<sup>48</sup> Based on the 2000 Census County Divisions encompassing the Grand Junction urban area (Grand Junction, Clifton, Fruita, Glade Park-Gateway, and Whitewater-Kahnah CCDs and the Montrose CCD. Table 5, 2000 Census of Population and Housing, PHC-3-7.

Montrose when modeling the impact of a mill located in the rural West End on Montrose County.<sup>49</sup>

Energy Fuels' economic modeling assumes that 80 percent of the operational mill jobs will be filled by current residents of the West End of Montrose County. It also assumes that 90 percent of all the mill employees will reside in the West End. As will be discussed later in this report, this may be an overly optimistic assumption. Applicants for the jobs will come from locations throughout the multi-county region in western Colorado and eastern Utah that can be reached by commuting to the mill. Workers may not want to invest in homes close to the mill for fear that a mill shutdown or perceived environmental problems associated with the mill and mining would reduce the value of their homes. We have nonetheless modeled the mill impacts assuming 80 percent of the mill employees would be residents of the West End. In that sense our estimates are on the high side.

### ***IMPLAN Modeling of Uranium Mine Reclamation in Rural Montrose County***

The Uravan Mineral Belt has 1200 uranium mines located within it<sup>50</sup>. In the history of uranium mining in the Uravan Mineral Belt, some 84 million pounds of uranium oxide were produced between 1936 and 1984.<sup>51</sup> Here we present an alternate scenario where the Piñon Ridge Mill is not built but the existing uranium mines in the Uravan Mineral Belt are cleaned up, sites reclaimed, and waste piles remediated.

This alternative has the advantage of improving the overall environment, livability, and attractiveness of this region rather than risking adding the “stigma” of turning the west ends of these three Colorado counties back into an industrial center that produces large quantities of long-lived radioactive waste. In the next section of this report we discuss that risk of creating a disamenity or stigma that discourages new residents, businesses, and visitors, thus weakening local economic vitality rather than enhancing it. In addition, with appropriate funding, such a reclamation-remediation program would not add instability to the local economy due to the cyclical fluctuation of uranium prices.

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<sup>49</sup> *If* the focus of the economic impact analysis was on the entire seven-county area of Colorado and Utah where the impacts of a revived uranium industry are likely to be felt, then we would certainly seek to take into account *all* of these impact. However, the focus of the socioeconomic analysis has been on the rural west ends of the three Colorado counties where the mill and some of the mines will be located. Adding, instead, primarily to the growth of the Grand Junction economy instead of supporting the rural West End of Montrose County is likely to be a somewhat lower priority to the rural areas that are supposed to be helped by the mill and mine developments and where the environmental costs and risks will be experienced. Exaggerating the positive impacts on the rural areas when the impacts will actually be in the larger rural areas is seriously misleading.

<sup>50</sup> <http://mining.state.co.us/UraniumMininginColorado.pdf>

<sup>51</sup> History of Uranium Prospecting and Mining in Colorado—a Story of Boom and Bust, *Rocktalk* 9(2), p. 4, Colorado Geological Survey, <http://geosurvey.state.co.us/portals/0/rtv9n2%20LR-web.pdf>

In 2006 the EPA published a technical report on uranium reclamation<sup>52</sup>. The EPA looked at the cleanup costs of 75 production facilities including 21 uranium mines. The report presents a “reasonable average” cost of cleanup per pound of uranium oxide ultimately produced.<sup>53</sup> Having an estimated monetary reclamation cost per pound of uranium ultimately produced, allows us to calculate a rough estimate of the total cost of cleaning up the Uravan Mineral Belt’s uranium mines. This modeling focuses on the jobs and worker compensation associated with cleaning up uranium mines instead of the creation of more uranium waste through a revival of mining and milling in the region.

### *Project Workforce and Population*

As mentioned above, the Colorado Uravan Mineral Belt is a rural area. There are no major population centers included within its boundaries. Because of the rural nature, we chose to model the reclamation of all of its uranium mines based on the four rural West End zip codes used for modeling the proposed mill and shown in Figure 15 above. We are not implying that all of the employment and income associated with this scenario will flow to the West End of Montrose County. The West End is an appropriate proxy for the larger Uravan Mineral Belt area because of its rural nature. Like the West End, much of the direct labor income will likely leave the area in the form of indirect and induced spending and employment to the larger population centers around the region. The West End however, is in the center of the Uravan Mineral Belt and will likely see an opportunity for significant employment under this clean up scenario.

### *Economy and Employment*

IMPLAN version 3 was also used in this modeling. Uranium mine reclamation was modeled using industry code 390, “waste management and remediation services,” which is the sector that best represents mine reclamation and remediation in IMPLAN. The zip codes that were modeled were again 81411, 81422, 81424, and 81431. See Figure 15.

Using the EPA uranium reclamation report value of \$5.16 of reclamation costs per pound of uranium oxide produced and the fact that the Uravan Mineral Belt has produced approximately 84 million pound of uranium oxide<sup>54</sup> it would cost about \$433 million to reclaim all of the mines in the Uravan Mineral Belt. Using this value as an input in IMPLAN for Industry sales allows us to look at the impact of this scale of reclamation on the rural Uravan Mineral Belt. Tables 7 and 8 show the results of the reclamation taking place over either a 10 or 20 year period.

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<sup>52</sup> Technically Enhanced Naturally Occurring Radioactive Materials From Mining - Volume 1: Mining and Reclamation Background

<sup>53</sup> EPA’s adjusted average was calculated by dropping the uranium operation with the highest cleanup cost and then taking the average of the remaining operations. This is the average of all of the mines being reclaimed minus the most expensive reclamation project. This essentially drops the cost of the outlier in an attempt to produce a more representative reclamation cost.

<sup>54</sup> History of Uranium Prospecting and Mining in Colorado—a Story of Boom and Bust, *Rocktalk* 9(2), p. 4, Colorado Geological Survey, <http://geosurvey.state.co.us/portals/0/rtv9n2%20LR-web.pdf>

The 10 year scenario is the amount of employment and money generated every year for ten years if all of the reclamation took place over a ten year period (Table 8). The direct employment would be 157 jobs per year with total employment (direct, indirect and induced) being 222 jobs per year. The labor income associated with the direct employment would be about \$15 million per year with the total labor income (direct, indirect and induced) being approximately \$18 million per year. The direct total output would be about \$43 million per year with a total effect of about \$54 million per year.

**Table 8**

**10-year Reclamation of Uravan Mines**

<b>Impact Type</b>	<b>Employment</b>	<b>Labor Income</b>	<b>Value Added</b>	<b>Output</b>
Direct Effect	157	\$ 15,057,022	\$ 23,932,906	\$ 43,333,331
Indirect Effect	37	\$ 2,294,920	\$ 3,742,029	\$ 6,617,105
Induced Effect	27	\$ 810,232	\$ 2,471,074	\$ 3,833,131
Total Effect	222	\$ 18,162,174	\$ 30,146,009	\$ 53,783,567

**Table 9**

**20-year Reclamation Uravan Mines**

<b>Impact Type</b>	<b>Jobs</b>	<b>Labor Income</b>	<b>Value Added</b>	<b>Output</b>
Direct Effect	79	\$ 7,528,511	\$ 11,966,453	\$ 21,666,666
Indirect Effect	19	\$ 1,147,460	\$ 1,871,014	\$ 3,308,552
Induced Effect	13	\$ 405,116	\$ 1,235,537	\$ 1,916,566
Total Effect	111	\$ 9,081,087	\$ 15,073,004	\$ 26,891,784

The 20 year scenario is the amount of employment and money generated every year for twenty years if the mine reclamation was stretched over 20 years (Table 9).

The direct employment would be 79 jobs per year with total employment (direct, indirect and induced) being 111 jobs per year. The labor income associated with the direct employment would be about \$7.5 million per year with the total labor income (direct, indirect and induced) being approximately \$9 million per year. The direct total output would be about \$22 million per year with a total effect of about \$27 million per year.

Note that a 20-year reclamation effort would have an impact similar to that we have estimated for the proposed mill. It should be kept in mind, however, that these two modeling efforts are not directly comparable since in the economic impact modeling of the mill, we explicitly did not include mining, hauling, and specialized mill jobs because the employees did not necessarily live in the West End. In the reclamation modeling, some of the employment and income impacts are highly likely to take place in rural areas outside of the Montrose County West End. Given that we find the assumption that almost all of the regular employees of the mill will live in the West End overly optimistic, our modeling of the impacts of the mill may be too high for the West End alone, just as our modeling of the impacts of a Uravan Belt reclamation program may also be too high for the West End alone. Both somewhat exaggerate the likely impacts on the West End.

## **5. Potential Negative Economic Impacts of a Revived Uranium Industry in the Uravan Region of Western Colorado**

### ***The Sources of Economic Vitality: A Restatement***

The sources of economic vitality over the last two decades in Montrose, Mesa, and San Miguel Counties have not primarily been in the traditional economic base: agriculture, mineral extraction, and manufacturing. Instead, the additional income flowing into these county economies has been associated with:

- i. the trade center roles of the cities of Grand Junction and Montrose as they provided medical, professional, technical, financial, and educational services as well as retail trade, cultural, and entertainment opportunities to a larger geographic area with a growing number of residents and income;
- ii. the flow of investment and retirement income into the region associated with the in-migration of large numbers of new residents including retirees;
- iii. the attraction of visitors to the region to enjoy the natural, recreation, and cultural amenities of the region.

All of these major sources of new income and employment rely directly or indirectly on the attractiveness of the region to new residents, businesses, and visitors. The region's economic vitality has been tied, among other things, to the social, natural, and cultural amenities of the region. For that reason, ongoing economic vitality is partially tied to preventing new economic activities that are land, air, and water intensive from damaging the very characteristics that have made this region an attractive place to live,

work, raise a family, and operate a business. As shown in an earlier section, these amenity-sensitive basic jobs represent over half of all basic jobs in the tri-country study area.

### ***The Potential Negative Economic Impact of Noxious Facilities***

Because of its legacy of environmental damage and radioactive pollution, a revived uranium industry in the region could threaten these existing sources of economic vitality. Past uranium milling and mining have been the source of serious environmental and health problems. The uranium mill town of Uravan in the West End of Montrose County was so polluted with radioactive materials that when the last uranium boom came to an end in the early 1980s and the mill shut down, the federal government ordered the town evacuated, all of its structures removed, and the town effectively obliterated. That was just the beginning of a nearly 25-year remediation<sup>55</sup> process that cost over \$120 million.<sup>56</sup> Similar costly mill cleanups took place in Naturita, Grand Junction, and Slick Rock at a cost of more than \$640 million.<sup>57</sup> The remnants of a mill near Gateway in the west end of Mesa County were remediated. Costly remediation of uranium mill sites is still underway in the Moab, UT and Cañon City, CO areas.

In addition to the remediation of the environmental damage and threats associated with these previous uranium mills serving the Uravan Mineral Belt, there are also the environmental problems associated with the more than 1,200 uranium mines that supplied those mills in the past. Most of these mines have been abandoned but few have been remediated and reclaimed. Among these mines are 32 active permitted mines in the tri-county area: 17 in Montrose, 13 in San Miguel, and 2 in Mesa County.<sup>58</sup> The primary public safety efforts thus far has been simply to put gates or other closure devices on those mines that represent a clear hazard. There have been, however, some efforts to reclaim and remediate mines in the vicinity of the old town of Uravan.<sup>59</sup> The need to remove, relocate, and/or isolate the mine wastes from these 1,200 uranium

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<sup>55</sup> "Remediation" typically refers to the collection and isolation or encapsulation of the toxic materials on site or near the site rather than the actual removal of the toxic materials. In some cases, as with the Naturita mill site and the Moab site the toxic materials have been moved to another site for encapsulation.

<sup>56</sup> U.S. EPA, News Release, 9-29-2008, "Cleanup of historic Uravan uranium mill completed," <http://yosemite.epa.gov/opa/admpress.nsf/3ee0a48cce87f7ca85257359003f533d/de3216b095602308852574d3006e8c12!OpenDocument>

<sup>57</sup> U.S. Energy Information Administration, Uranium Mill Sites Under the UMTRA Project, <http://www.eia.doe.gov/cneaf/nuclear/page/umtra/title1sum.html>.

<sup>58</sup> Uranium Mining in Colorado 2010, Colorado Division of Reclamation, Mining, and Safety, updated June 28, 2010. For the number of uranium mines in the Colorado portion of the Uravan Miner Belt see: <http://mining.state.co.us/UraniumMininginColorado.pdf>.

<sup>59</sup> The Colorado Department of Public Health and Environment (CDPHE) and the Division of Minerals and Geology, now known as the Colorado Division of Reclamation, Mining and Safety (DRMS), have entered into a contract whereby CDPHE allocated \$852,360.00 from the Uravan Natural Resource Damage Fund for DRMS to reclaim and safeguard abandoned, historical mine areas to benefit terrestrial and water resources and optimize riparian habitat along the San Miguel River in Montrose County. This has involved moving some material out of the floodplain, backfilling some pits, and moving some waste rock back to a mine. However, this activity is relatively small compared to the total number of abandoned mines.

mines remains one of the legacies of the several mining booms in this area over the last 100 years. This mining legacy unavoidably has an effect on the environmental character of the area.

As discussed earlier, there is convincing economic evidence that people care where they live and that they act on those preferences, making economic sacrifices to pursue locations that are attractive to them and expending effort and resources to escape or avoid locations that they perceive to be inferior or noxious. That, at the most basic level, is what “high rent” and “low rent” neighborhoods are all about. It would be economically shocking if this were not true. After all, subjective preferences for certain goods and services are what determine the economic demand that drives the commercial economy. Guided by their subjective preferences, people buy different “tasty” foods, different “stylish” clothes, different interior designs, different entertainment, different landscaping for their homes, different styles of cars or trucks, etc. It would be jarring and disturbing to economists and real estate professionals if they were to discover that people did not have preferences for the character and qualities of the place where they lived and raised their families and/or that those preferences did not affect their behavior when choosing a location and purchasing a home.

The empirical evidence is quite the contrary. Analysis of what home buyers and renters are willing to pay clearly indicates that they pay significantly more to reside where air quality is better, the threat of crime to person and property is lower, congestion and noise are lower, etc. They also are willing to pay to live closer to parks and other open space, better schools, lake and ocean sides, scenic vistas, etc.

Those same studies of people’s willingness to pay to gain access to public amenities and avoid public disamenities have also documented the impact of noxious facilities or environmental risks on home values. Superfund sites, polluted surface and ground water, land fills, regular severe air pollution events, animal feedlots and processing facilities, airport landing lanes, high voltage power lines, heavily used railroads and highways, large industrial facilities, coal-fired and nuclear electric generators, to name just a dozen potentially “noxious” settings, tend to drive down property values.<sup>60</sup>

This is a common enough phenomenon that real estate professionals as well as economists talk about the “stigma” that comes to be attached to certain areas because of the perceived noxious or dangerous characteristics of a particular location. That “stigma” tends to discourage residential and business location, reducing the demand for and value of local property, and reducing local economic vitality. It is important to understand that this stigma is not necessarily tied to narrow, technical expert opinion

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<sup>60</sup> For recent review articles summarizing this literature see: “A Meta-Analysis of the Effect of Environmental Contamination and Positive Amenities on Residential Real Estate Values, *Journal of Real Estate Research*, Robert A. Simons and Jesse D. Saginor, 2006; “The Impact of Superfund Sites on Local Property Values: Are All Sites the Same?, Katherine A. Kiel and Michael Williams, *Journal of Urban Economics*, 2007, 61:170-192; “The Effects of Environmental Contamination on Real Estate: A Literature Review,” Thomas O Jackson, *Journal of Real Estate Literature*, 2001; Undesirable Facilities and Property Values: A Summary of Empirical Studies, Stephen Farber, *Ecological Economics*, 24(1998):1-14.



about environmental risks but to popular perceptions and judgments that emerge from the public dialogue about the negative qualities associated with a particular site.<sup>61</sup> That role of subjective judgments in motivating economic action, of course, is not unusual in a market economy. As pointed out above, buyers' subjective preferences are one of the primary forces behind economic demand in most markets.

### ***The Potential "Stigma" Associated with Uranium Milling and Mining***

There are two characteristics of uranium mining and milling that could lead to a negative impact on the local economy. They are also the characteristics that led to costly uranium mill and mine cleanup efforts that began in the Uravan Mineral Belt area in the mid-1980s and continue today. First, only a very tiny percentage of the uranium ore, about 0.2 percent, is actually recoverable uranium. The vanadium concentration is higher, but only about one percent. This means that huge volumes of waste "tailings" are generated in the process of recovering the uranium and vanadium. Most of the radioactivity of the ore remains in those waste tailings. Second, the uranium ore itself is radioactive not just due to the presence of the uranium being sought but also associated with the radioactive decay of the other uranium isotopes and elements as uranium decays toward lead. The radioactive nature of uranium, of course, is why it is sought, to fuel both nuclear reactors generating electricity and nuclear weapons. That radioactivity is also the source of human health concerns.

Most of the mines supplying the proposed Piñon Ridge mill would be conventional underground mines. Although miners seek to remove only the uranium ore from the mine, the highly mechanized mining methods involve also removing rock with no or only non-commercial amounts of uranium. The rock without a high enough concentration of uranium for commercial milling is separated from the desired ore at the mine site. The remaining waste rock, which can be contaminated with radioactive materials and the precursors of acid mine drainage, is stored near the mine site indefinitely.

The remaining uranium ore, however, is also 98.8 percent waste material, which, after most of the uranium and vanadium have been removed, has to be stored at the mill site. These large volumes of waste have to be handled carefully because they remain toxic even after the uranium is removed. About 85 percent of the radioactivity of the ore remains after the uranium has been removed from it because uranium milling only seeks to remove one of the radioactive components of the ore, the uranium. The milling leaves other radioactive materials as well as a significant amount of uranium in the waste product. The radioactive elements that make up the waste product are not just radioactive for a little while. The half life of uranium 238 is 4.5 billion years, the half life of uranium 235 (the isotope that the mines and mills are after) is 700 million years, and the half life of radium is 1600 years. As a result, once this material is dug from the

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<sup>61</sup> See "Section III. Stigma," pp. 23-27 in Socioeconomic Analysis Receipt of Maywood Material: Cotter Corporation Milling Facility," RPI Consulting Inc., prepared for Fremont County, May 2003. Also see "Evaluating Environmental Stigma with Multiple Regression Analysis," Thomas O. Jackson, *The Appraisal Journal*, 2005; "Stigma and Value" Bill Mundy' *The Appraisal Journal*, 60(1) 1992,

ground and concentrated on the surface of the earth, it becomes a hazard to life for time scales that are very hard for humans to comprehend. In addition, the tailings contain other toxic materials including heavy metals and the chemical solvents used to extract the uranium. That makes disposal of the tailings a serious toxic waste problem.<sup>62</sup>

It was the improper handling of these large volumes of waste rock at mine sites and the tailings and chemical reagents at the mill sites that created the costly toxic waste problems associated with previous uranium and vanadium booms. In the Uravan Mineral Belt, the obliteration of the town of Uravan in order to remediate the extensive radioactive pollution stands as a reminder of how severe the consequences can be of mishandling radioactive materials.

When they were first discovered, naturally radioactive materials were seen as benign curiosities, important scientific tools, materials used for illuminating clock and watch dials at night, and for hypothesized cures for various diseases. The health dangers associated with these radioactive materials were not widely recognized until well into the 20<sup>th</sup> century. Madame Curie, who won two Nobel prizes for her explanation of radioactivity and her discovery of radium and other new elements, died of what is now diagnosed as radiation poisoning. With the building of the first atomic bombs around a uranium core, the power and dangers of radioactive materials became well known. Civil defense training of the citizenry in preparation for nuclear warfare and health concerns over radioactive fall out from the testing of nuclear weapons in the atmosphere educated the public about the dangers of radioactive materials. Nuclear accidents, large and small, reinforced the health concerns associated with radioactivity.

The health consequences to miners associated with past uranium mining reinforces the perceived risk. As of the end of November 2010, the federal government had paid about \$700 million to former uranium workers or their families for the diseases and deaths associated with their exposure to radiation during employment in uranium mines and mills and in hauling uranium ore.<sup>63</sup> These payments have been made under the Radiation Exposure Compensation Act (RECA) which provides compensation awards of up to \$100,000 each to people who worked in the uranium industry between 1942 and 1971.<sup>64</sup> Unfortunately, uranium workers employed after 1971 are not eligible for such compensation benefits under that law.

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<sup>62</sup>National Research Council. *Scientific Basis for Risk Assessment and Management of Uranium Mill Tailings*. Uranium Mill Tailings Study Panel, Board on Radioactive Waste Management, Commission on Physical Sciences, Mathematics and Resources, National Research Council. National Academy Press (Washington, DC), 1986; p. 10. U.S. Environmental Protection Agency. *Final Environmental Impact Statement for Standards for the Control of Byproduct Materials from Uranium Ore Processing (40 CFR 192)*. EPA 520/1-83-008-1, September 1983, Volume I; p. 3-1. Tsivoglou EC, O'Connell RL. *Waste Guide for the Uranium Milling Industry*. U.S. Department of Health, Education and Welfare, Public Health Service, Robert A. Taft Sanitary Engineering Center (Cincinnati), Technical Report W62-12, 1962; p. 5.

<sup>63</sup>U.S. Department of Justice, Civil Division. Radiation Exposure Compensation System Claims to Date: Summary of Claims Received by 07/28/2008; All Claims. ([http://www.usdoj.gov/civil/omp/omi/Tre\\_SysClaimsToDateSum.pdf](http://www.usdoj.gov/civil/omp/omi/Tre_SysClaimsToDateSum.pdf))

<sup>64</sup>U.S. Department of Justice. Radiation Exposure Compensation Program. About the Program. (<http://www.usdoj.gov/civil/torts/const/reca/about.htm>)

These past health damages and expensive toxic waste cleanups are reminders that radioactive material that is not handled very carefully can do significant damage. As with other risks to our health that cannot be directly sensed (disease pathogens, poison gas, etc), radioactivity raises additional fears because of its “mysterious” or “insidious” nature.

Energy Fuels proposes to help “jump start” a revival of the uranium industry in the West End of Montrose County by building a uranium mill that will then make feasible (if the price of uranium is high enough) the revival of uranium mining in the region. The mill, within in economic hauling distance of the area’s uranium mines, will allow the extraction of concentrated uranium oxide which is then economic to transport to enrichment plants across the nation. To the extent that Energy Fuels is successful in reviving the uranium industry in the west ends of Mesa, Montrose, and San Miguel Counties and making that region a uranium production zone some attention must be given to how that type of industrialization of these rural areas may affect other potential sources of economic vitality because of the perceived environmental risks associated with the uranium industry.

### ***Residents’ and Potential Residents’ Concerns about Radioactive Waste***

In 2003 RPI Consulting of Durango, Colorado, was commissioned by Fremont County Commission to study the socioeconomic impacts of the proposal by Cotter Corporation to import, process, and store radioactive waste from outside of Colorado.<sup>65</sup> The waste would be stored at the Cotter Corporations uranium mill adjacent to Cañon City, CO. One of the concerns expressed by residents was that if this area became a national waste dump for radioactive material, that identification of the greater Cañon City area with nuclear waste would damage its economy, its growth potential, and property values.

As part of its analysis of whether this additional radioactive waste storage would “stigmatize” and damage the local and regional economy, RPI Consulting conducted a statewide survey of Coloradans to determine if and to what degree Colorado residents were concerned with radioactive materials. Interviewees were told that the radioactive materials would be stored in facilities that met state and federal environmental standards. Nevertheless, most respondents (91 percent) indicated that they were concerned about health risks and economic risks associated with living adjacent to radioactive waste storage. In addition, 58 percent of those residents questioned believed that there was some likelihood that the additional radioactive waste storage would lower property values. Also, 53 percent of residents were concerned that the environment would be damaged.<sup>66</sup>

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<sup>65</sup> Socioeconomic Analysis Receipt of Maywood Material: Cotter Corporation Milling Facility,” RPI Consulting Inc., prepared for Fremont County, May 2003.

<sup>66</sup> Ibid. Figure 15, p. 25.

When asked if the presence of stored radioactive materials in their county of residence would cause them to relocate, 58 percent of the Fremont County residents interviewed said that such relocation was not at all likely or not very likely. Statewide respondents appeared to be somewhat more adverse to radioactive materials. Only 42 percent reported that they were unlikely to move to another county; 56 percent said that they were very likely or somewhat likely to relocate. In Fremont County 40 percent of respondents said they were at least somewhat likely to move.<sup>67</sup>

The respondents also indicated that it was residing in close proximity to radioactive materials that most bothered them. While 55 percent said that they would be willing to reside 10 miles or more from the radioactive materials only 16 percent said that they were willing to live within a mile of those materials<sup>68</sup>.

These responses by Colorado residents were similar to the results of economic analyses of people's reactions across the nation to noxious facilities. The strength of the aversion declines with distance from the facility. In addition, the impact on residential location is not so much due to residents relocating out of the area to avoid the perceived environmental and health risks but, rather, due to a decline in the likelihood of new residents in-migrating into the area. Depressing in-migration, one of the forces supporting economic vitality in our tri-county study region, could lead to a slowed or stagnant local economy.<sup>69</sup>

RPI Consultants also surveyed Fremont County real estate professionals about the past impact on property values of the presence of the Cotter uranium mill and its associated stored radioactive wastes before the proposal was made to begin storing out-of-state nuclear waste. About 60 percent said it had no impact or they weren't sure it had any impact. Another 16 percent thought the presence of the mill actually boosted property value, possibly because of the employment opportunities the mill provided. Only 9 percent said the mill had depressed property values. When asked about increasing the stored waste by accepting out of state waste, 57 percent said they thought that would lower property values while 29 percent said it would have no impact and 4 percent said it would boost property values slightly.<sup>70</sup>

RPI Consulting did *not* conclude that the Fremont County economy would be damaged by the expansion of radioactive waste storage at the Cotter mill. Rather RPI laid out what evidence there was that the expansion of the storage of radioactive materials might cause residents, potential residents, visitors, and businesses to react negatively to such a location. Economic decisions based on those negative reactions, such as avoiding the area, can reduce local economic vitality. RPI Consulting also pointed out that there was evidence from elsewhere in Colorado and around the nation that local economies can thrive despite the presence of radioactive materials in the area. That

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<sup>67</sup> Ibid. Figure 16, p. 25.

<sup>68</sup> Ibid. Figure 17, p. 26.

<sup>69</sup> "The Association between Environmental Risk and Internal Migration Flows," Lori M. Hunter, ***Population and Environment***, 1998.

<sup>70</sup> Op.cit. RPI Consulting, p. 37.

makes forecasting exactly what the impact of concentrations of radioactive materials at any particular location difficult. RPI Consulting tried to lay out the range of likely outcomes from near zero impacts to modest but significant local economic costs. The intention was to layout the possible range of risks associated with the proposal to become a national nuclear waste dump and compare that to the relatively modest potential commercial economic benefits associated with the proposed expanded storage so that citizens and decision makers could make a more informed decision.

Partially on the basis of this analysis of the risks and benefits to the local economy, the Fremont County Commissioners opposed Cotter Corporations proposal to import more nuclear waste and the State of Colorado denied Cotter the permits to do so.

Other jurisdictions in the West have also sought to analyze the impact that radioactive facilities may have on local economic vitality. The State of Nevada and City of Las Vegas have been concerned about the potential impact of the Yucca Mountain high-level radioactive waste repository proposed for a site about 90 miles from Las Vegas. The concern was with both the location of the storage site and the need to transport the nuclear wastes on public highways through Nevada's urban areas. Both those urban areas and the state of Nevada as a whole emphasized that their economies relied on recreation and entertainment and they funded a significant amount of research on the source and impact of environmental stigma. That research, too, documented the very negative mental image associated with radioactive materials and that this posed a risk that potential visitors, new residents, and business would make alternative location decisions that shifted economic activity away from Nevada and the Las Vegas area.<sup>71</sup>

In 2000 the Louis Berger Group, the consulting firm that prepared the socioeconomic impact study from Energy Fuels' proposed Piñon Ridge mill, did an "Assessment of Hazards of Transporting Spent Nuclear Fuel and High Level Radioactive Waste to the Proposed Yucca Mountain Repository Using the Proposed North Las Vegas Beltway" for the City of North Las Vegas. It concluded that the perceived environmental risks and stigma effects associated with radioactive materials would lead to much reduced commercial development in the area around the highway that would be carrying the nuclear waste. In particular, the Louis Berger Group projected very little office development in the area, an impact that could significantly slow the expansion of the area economy in the following decades. An earlier economic analysis in the southeastern United States had found that there was empirical evidence that residential property values were depressed near a highway that carried radioactive waste through the Charleston, SC, urban area.<sup>72</sup>

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<sup>71</sup> 2000, State of Nevada Comments, Appendix I, Radioactivity, Stigma, and Socioeconomic Impacts: The Need for an Assessment of Impacts on Nevada's Principal Economic Sectors in the U.S. Department of Energy's Yucca Mountain Draft Environmental Impact Statement.

<sup>72</sup> Interestingly, that study did not find depressed property value in the rural areas through which the nuclear materials were hauled. "Nuclear Waste Transportation and Residential Property Values: Estimating the Effects of Transient Perceived Risks," Kishore Gawande and Hank Jenkins-Smith, *Journal of Environmental Economic and Management*, 42(2):207-233, September 2001.

The U.S. Department of Energy, which was charged with building the Yucca Mountain waste storage facility, disputed Nevada's and Las Vegas' views of the risks to the state and local economies. The Department of Energy argued that because the Yucca Mountain site was 90 miles away from Las Vegas, there would be little stigma because the negative impacts of noxious facilities decline significantly with distance. Unless there were a serious accident at the storage site or a series of smaller accidents in the process of transporting nuclear wastes to it, the Department of Energy did not believe people living in distant urban centers would be concerned enough about the nuclear waste facility to behave in ways that would reduce property values, discourage tourism, or otherwise damage the economy.<sup>73</sup>

This response by the proponent of a radioactive facility and its associated radioactive activity is typical of the frustration that technical experts feel when confronted by what, in their minds, is an uninformed, almost hysterical, response by the public to a proposal that they believe is objectively much less dangerous than the public assumes. That, however, is the economic reality when it comes to environmental stigma. What matters is the subjective judgment that local residents and businesses actually make about the perceived risks and how those subjective judgments affect their economic behavior. To the extent that economic behavior is driven by subjective judgments that experts believe to be wrong, the economic losses will nonetheless be real. Public relations campaigns can seek to change people's minds, but, as with all economic transactions, individual preferences and judgments drive the outcomes in market economies. To the extent that people are worried about radioactive materials moving through their communities or worry about a low probability but possibly high impact accident, they may behave in ways that reduce property values and local economic vitality. We *know* that is the case. People seek to avoid living in proximity to a broad variety of activities that create what they judge to be nuisances or hazards.

In the west ends of Mesa, Montrose, and San Miguel Counties, it is likely that many residents, because they are familiar with uranium mining and milling may have positive or neutral attitudes towards a revival of that industry. That is, to many existing (especially long-term) residents, there may be little or no stigma. In the study of the impact of transporting nuclear wastes on property values in South Carolina, no impact was found along the rural sections of the highway, only on the urban sections. The analysts speculated that rural residents are more familiar with environmental and other risks and expect to be able to safely balance these risks and benefits themselves. Some of the media stories that have been written recently about how residents in the West End of Montrose County have responded to the proposed Piñon Ridge uranium mill suggest that this might be true in the Paradox Valley although there are also reports that interest in purchasing property in the west end of the Valley near the town of Paradox

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<sup>73</sup> "Are Fear and Stigmatization Likely, and How Do They Matter? Lessons from Research on the Likelihood of Adverse Socioeconomic Impacts from Public Perceptions of the Yucca Mountain Repository," Robert O'Connor, Jason Technologies Corporation, September 8, 2001, Appendix N to Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, DOE/EIS 0250.

has cooled since the proposal to revive the uranium industry in the area have become public.<sup>74</sup>

This attitude on the part of long-time residents, however, does not eliminate the possibility that in turning back to uranium, the region could be foreclosing more stable and sustainable economic alternatives. “More of the same” or “a return to the past” are rarely good economic development strategies. Economies are more dynamic and complex than that. A broader overview needs to be taken of just how revived uranium mining and milling fit into an overall sustainable economic development policy for the region.

To the extent that the existing economic vitality in Mesa, Montrose, and San Miguel Counties is at least partially tied to what has been labeled amenity-supported local economic development built around the ongoing in-migration to an area perceived to provide high quality living environments, it is important to examine the possibility that a revived uranium industry would undermine that existing source of economic vitality. Recall that all three of our study area counties have seen significant population growth primarily supported by the net in-migration of new residents. Between 1990 and 2009 net in-migration added about 50 percent to each of these counties’ populations. For Montrose and Mesa Counties more than 80 percent of the growth was due to net in-migration. For San Miguel over 60 percent of population growth was the result of net in-migration. About 70,000 new residents moved into the region during this time period. Just as attractive characteristics of an area can draw new residents and businesses, noxious characteristics can do the opposite: repel potential residents and businesses.

### ***Dealing with Uncertainty***

Although we *know* that people generally avoid noxious and/or dangerous location when they choose their place of residence, we do not know exactly how potential residents, visitors, and new businesses will evaluate the presence of a revived uranium industry in the Uravan Mineral Belt counties. This uncertainty is not unusual when developing public policy. When a tax is imposed or cut, when zoning or environmental regulations are adopted or modified, when investments are made in schools, roads, and parks, when the police or firefighting force is expanded or contracted, etc. we also cannot be certain exactly what the impact will be on the economy. Sometimes we are not certain even what the direction of the impact will be. Despite that uncertainty, we still have to make informed judgments as to how to proceed. The same is true of the impacts associated with a revived uranium industry centered on the proposed uranium mill in the West End of Montrose County. We do not really know exactly what the conventional employment, income, and fiscal impacts will be since we do not know where the workers will come from or where the miners’ families, the mines, and the mill will spend their income. We also do not know how stable a revived uranium industry will be and

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<sup>74</sup> “The Uranium Widows,” Peter Hessler, *The New Yorker*, September 13, 2010, p. 30; “Colorado’s New Uranium Boom in Paradox,” Stephen Allen, *Denver Environmental News Examiner*, May 12, 2010; “The Half-Life of Belonging,” Jen Jackson, *Inside/Outside Southwest* magazine;

how long the jobs, incomes, and tax revenues will last before the next bust hits and how long that bust will last. Finally, we do not know how large the negative “stigma” impacts will be on the amenity-supported economic vitality the tri-county area as enjoyed over the last two decades.

Of course, it is not just governments who have to make decisions despite the uncertainty that surrounds the future. Businesses have to do it every day and many small businesses regularly fail. Most of the major life decisions individuals have to make are also embedded in uncertainty: where to go to college, what job to take, where to live, when and who to marry, etc. We rarely make decisions in a context of certainty about outcomes.

A public decision has to be made about the proposed Piñon Ridge uranium mill and its associated uranium mines. Careful decision making would weigh as carefully as possible all of the potential positives and negatives, benefits and costs, associated with the proposed mill. Looking at the relative size and likelihood of the expected jobs, income, tax revenues and public expenditures, do those positive features more than justify the downside risks associated with additional radioactive waste and pollution problems and the impact of that on the other sources of economic vitality in the region: amenity in-migrants including new small businesses and the visitor economy. The past and expected future instability of the uranium industry and its expected impact on the reliability and duration of the positive economic impacts also has to be considered.

We turn to this latter topic next.

## **6. The Instability in the Uranium Industry and Its Implications for Uranium-Dependent Communities**

### ***The Historical Experience in Western Colorado***

Between 1930 and 1960 the population of the West End of Montrose County quadrupled as both uranium and vanadium mining and milling expanded to meet the needs of World War II and the Cold War weapons programs. That thirty year growth pattern was followed by a 30 year contraction once the uranium price supports justified by national security interests began to be dismantled during the 1960s and the uranium industry was largely left to market forces. That steep decline in population was interrupted by a revival of uranium mining for civilian nuclear power in the 1970s but the loss of population continued with the uranium bust of the 1980s. See Figure 16.

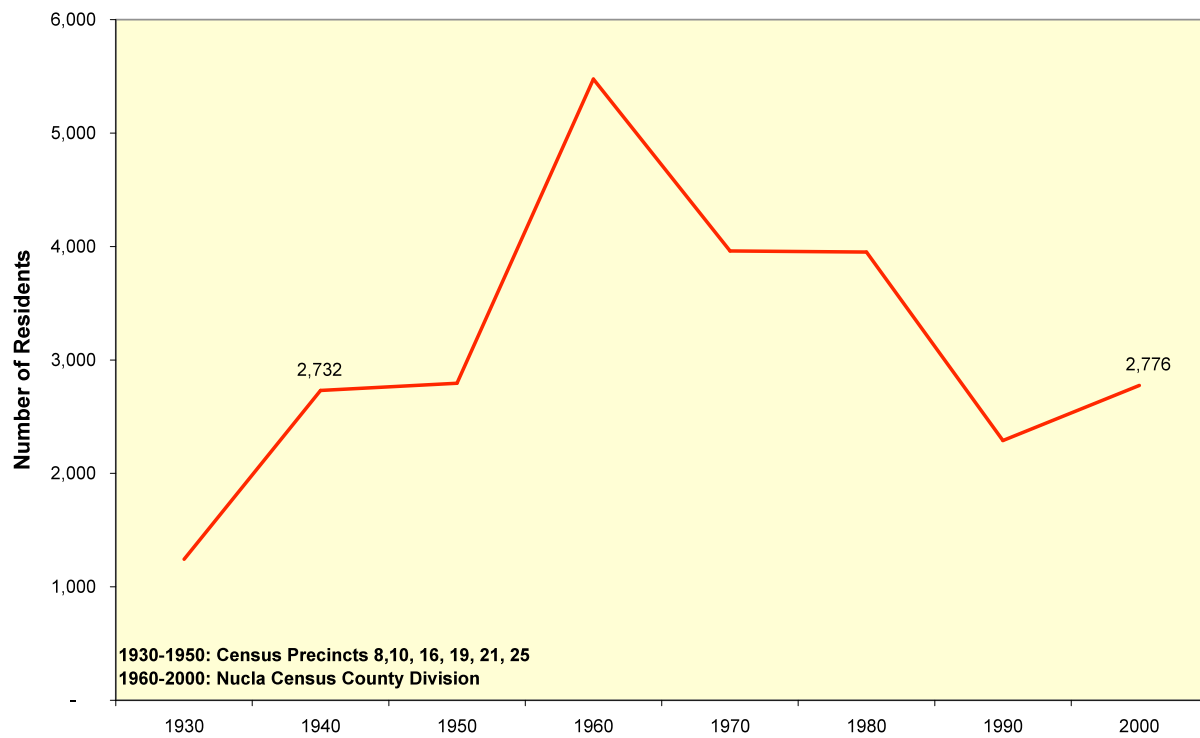
A similar pattern of population gain and loss took place in southwestern Mesa County and western San Miguel County. The dramatic decline in real earnings in the metal mining industry, which in our tri-county study area is dominated by uranium, confirms the shock to these rural areas. Over 90 percent of that \$82 million metal mining payroll in 1979 was lost by 2000. Most of it was lost in the six-year period, 1979-1985. This was



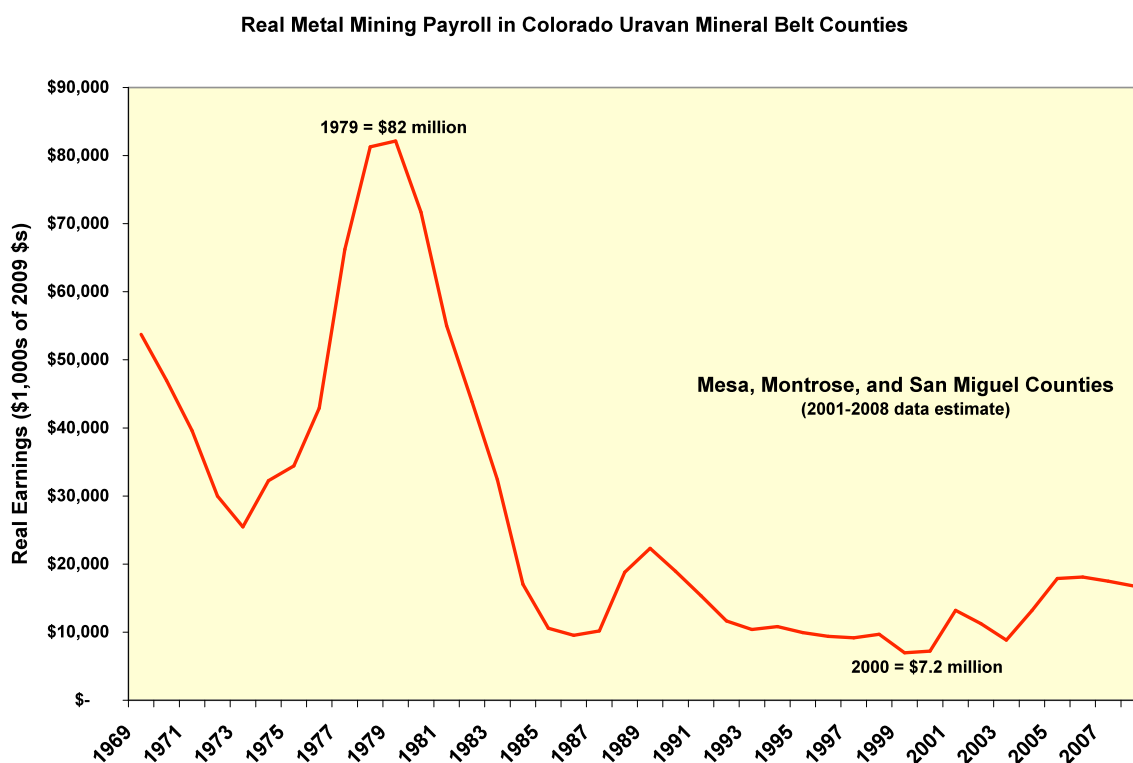
not the first time the region had been disrupted by a decline in the uranium industry. Mining payroll and regional population also plummeted in the 1960s as the industry adjusted to a market setting. See Figure 17.

**Figure 16**

**Population of the West End of Montrose County: 1930-2000**



**Figure 17**



### ***Instability Across the Metal Mining Industries***

It was not only uranium ore mining and processing that suffered major reverses in the early 1980s, and it was not only in western Colorado. Copper mining and smelting also largely collapsed in New Mexico, Arizona, Montana, Utah, and Michigan. The iron mining industry of Minnesota and Michigan also largely shut down.

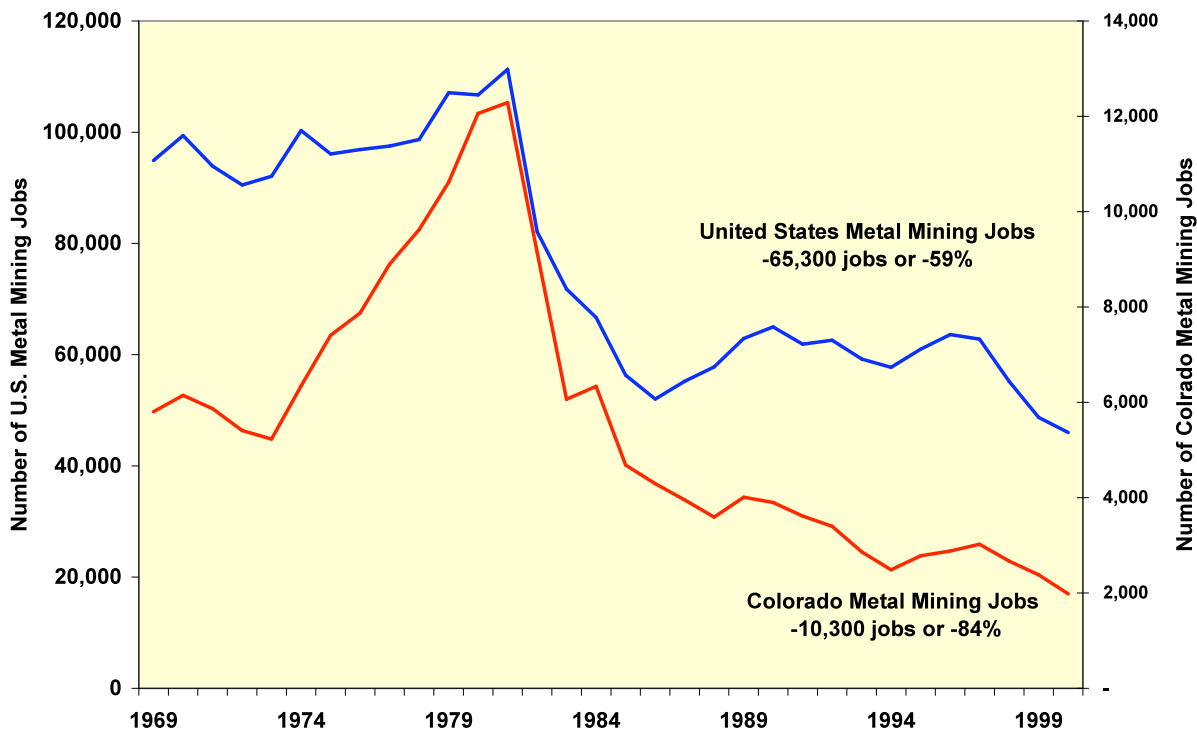
Nationwide almost 60 percent of metal mining jobs, including uranium mining jobs, were lost between 1981 and 2000, a loss of over 65,000 jobs. In Colorado 5 out of 6 metal mining jobs were lost during the same period, a loss of over 10,000 jobs. See Figure 18. By the early 2000s, the copper mining job losses in the United States had neared 80 percent, or 30,000 jobs. In addition, many metal smelters and refineries shut down, laying off many thousands more metal workers. As with uranium, after 2003 metal prices rebounded only to plummet again in 2009. Unlike uranium, during 2010 some metal prices rebounded dramatically as did some metal mining production. This is not shown in Figure 18 because the federal government no longer reports metal mining at the state and local level as a specific sub-category of mining.

The reason for discussing the declines in uranium, copper and iron mining at the same time is to underline the fact that there were international economic forces operating between 1980 and 2000 that affected metal mining nationwide, not just uranium mining

and not just in western Colorado. As the United States' economy was increasingly integrated into the world economy, American mining and manufacturing faced increased competition from production around the world that brought metal prices down, rendering many American operations uneconomic.

**Figure 18**

**Colorado and United States Metal Mining Employment**

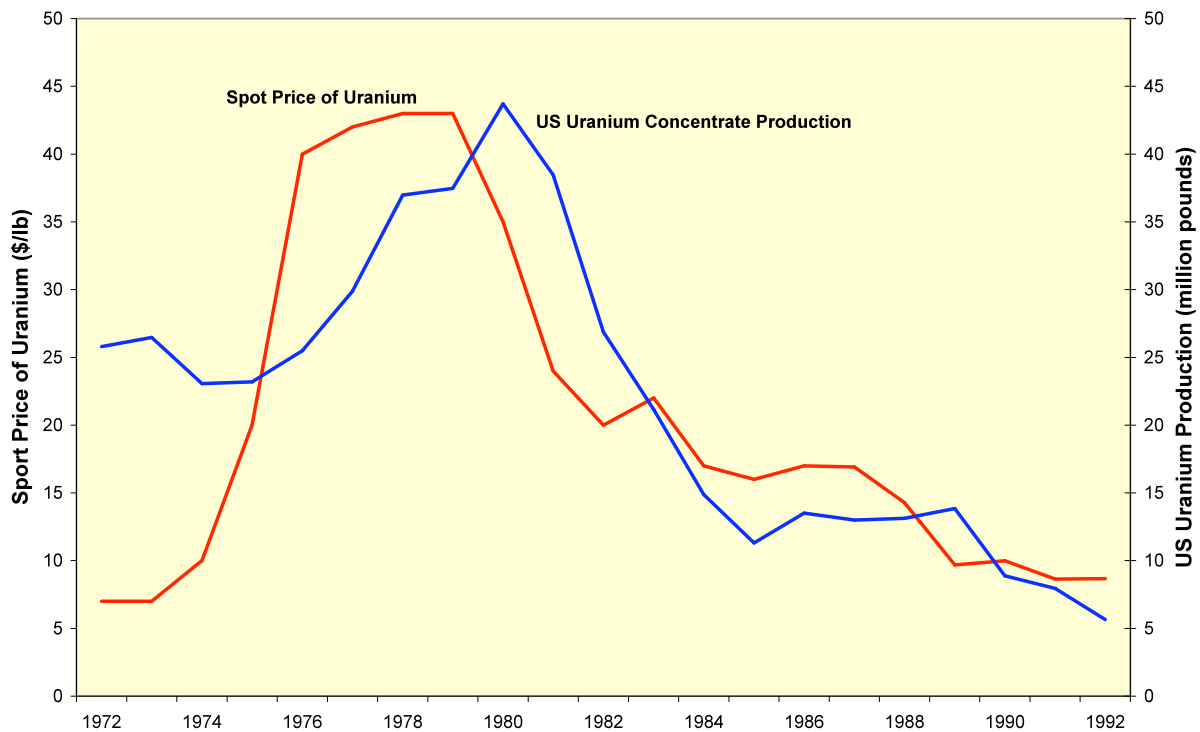


This is a familiar pattern in metal mining. High commodity prices bring new mines and additional production on line around the globe. The resulting increase in supply then puts downward pressure on metal prices, undermining the viability of the higher cost operations that are forced to shut down. That reduction in supply helps absorb the excess production and prices stabilize. As the world economy expands, demand for metals grows and metal prices begin to rise, again stimulating actions that expand supply. This cycle tends to be regularly repeated.

That price and production pattern can be seen in the expansion and then dramatic contraction in uranium production in the United States and Colorado in the 1970s and 1980s. As uranium prices rose, so did production until supply exceeded demand and uranium prices plummeted as did uranium production after a lag of a couple of years.. See Figure 19

**Figure 19**

**Uranium Prices and Production: 1972-1992**



It is the volatility of metal prices that leads to instability in employment and payroll in the metal mining and processing industry. It is important to keep that in mind in evaluating the current price for uranium along with many other metal prices including copper. If uranium prices are adjusted for inflation (i.e. converted to “real” prices), current uranium prices are not unprecedented. They were as high or higher in the 1970s at the time of the last uranium boom in western Colorado, just before the bust of the 1980s. Figure 20 contrasts such “real,” inflation-adjusted prices with the actual (“nominal”) prices. Also note the continued volatility in uranium prices: They fell 70 percent from their mid-2007 peak of \$138 per pound to \$40 per pound in May 2010. By November 2010 uranium prices were approaching \$60 per pound.

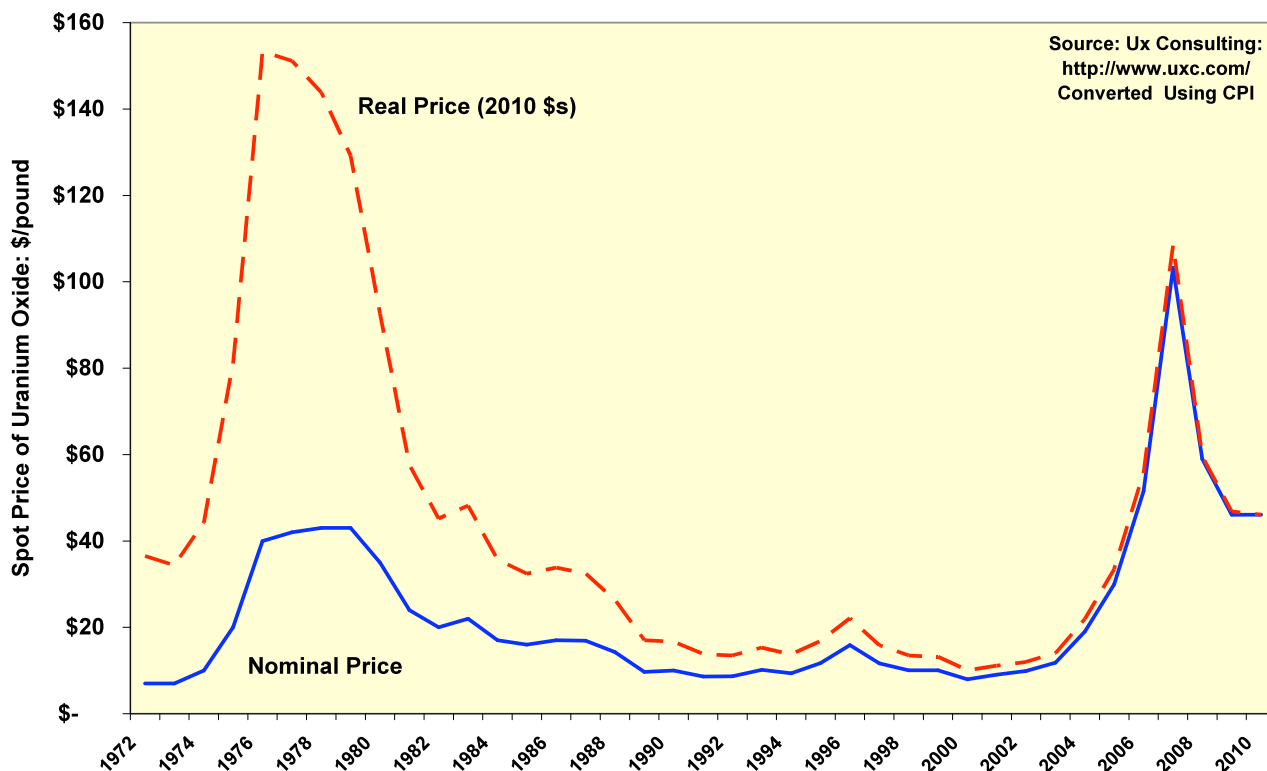
Also note that the real price of uranium was above \$50 per pound (real) for only seven years in the boom of the late seventies and early eighties. In the most recent fly up in uranium prices, the price was above \$50 for only about two years before falling to around \$40. In early December 2010 it was again above \$50.

Energy Fuels projects its economic impacts by assuming that its proposed mill and associated mines will operate uninterrupted for 40 years, possibly shifting from 500 tons per day to 1,000 tons per day. There is no uranium mine or mill in the United States that has performed with such sustained stability. Economic projections based on such

assumptions are fantasies that do not lay the basis for reasonable socioeconomic analysis.

**Figure 20**

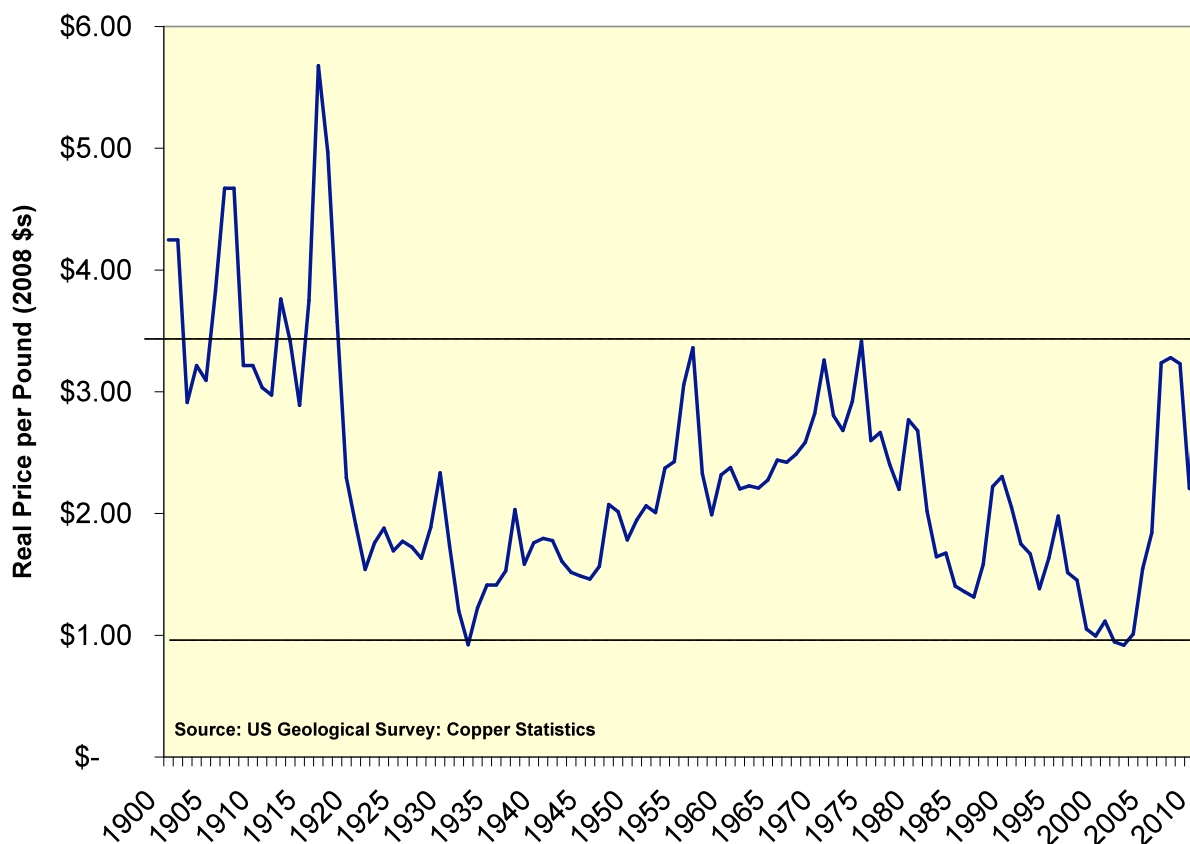
**Uranium Spot Market Prices: Annual Average, Nominal and Real**



Because federal regulation and subsidies controlled uranium production between 1940 and the mid-1960s and releases from US and Russian government stockpiles has affected market supply since the end of the Cold War, it could be argued that the uranium price and production swings were not primarily due to market forces but to government policy. However, if we look at other metal prices, we see similar wide fluctuation in market prices. Figure 21 shows over a century of real copper price fluctuations. Note that the recent peak copper prices are not historical peaks in real terms. Similar peaks were seen in the 1950s and 1970s as well as in the early 20<sup>th</sup> century. Also note that copper prices regularly fell dramatically after reaching those peak values. For instance, between 1914 and 1916 real copper prices rose 97 percent followed by a 73 percent decline between 1916 and 1921 that wiped all of the gains and then some. Between 1949 and 1956 copper prices rose by 89 percent followed by a 40 percent decline between 1956 and 1958, almost carrying copper prices back to their previous level. High prices were rarely sustained for more than a few years in this international commodity market.

Figure 21

Changes in Real Copper Prices 1900-2008



### Shortages of Uranium and Future Higher Prices?

Because there is not an organized uranium market in which uranium is bought and sold in a relatively transparent manner, there is less information available and more uncertainty than, for example, in gold or copper markets. Most uranium transactions involve private bilateral deals. In addition, government decisions control a significant part of the overall supply of nuclear materials. Private consulting firms estimate both spot market and average long-term contract prices. This private price estimation adds to the uncertainty and makes the uranium market particularly susceptible to speculative swings in apparent prices.<sup>75</sup>

From a longer run point of view (the next 10 to 20 years), there was no reason to believe that uranium prices will remain as high as they were in mid-2007. There is no shortage of known uranium ore deposits around the world. The World Nuclear Association, a global nuclear energy advocacy group, estimated in 2010 that world's present resources could serve existing demand for uranium from conventional nuclear

<sup>75</sup> UxC Consulting publishes the UxC Weekly and TradeTech publishes The Nuclear Market Review.

reactors for about 80 years. It commented that “This represents a higher level of assured resources than is normal for most minerals.”<sup>76</sup> The 2010 Uranium Red Book estimated that there are sufficient identified conventional uranium reserves to meet current usage rate for 100 years. If other, less certain, uranium reserves are included in the count, hundreds of years of supply are projected to be available.<sup>77</sup> For the shorter term, through the coming decade, Denison Mines, owner of the Blanding Uranium Mill, in its presentation to its stockholders at its 2010 annual meeting, cited the Uranium Market Outlook of Ux Consulting Company showing adequate supply to meet demand through at least 2018.<sup>78</sup> That projection, however, assumes a significant decline in the availability of unconventional sources of uranium, limited development of new supply sources, and an ambitious nuclear construction programs around the world.

Technological advances in nuclear reactor design could considerably expand that effective supply by increasing the efficiency with which energy is extracted from the nuclear fuel. Currently only a small fraction of the total energy contained in uranium fuel is used.<sup>79</sup> The rest remains in the highly radioactive waste materials that have been so difficult to disposed of.

Uranium production companies *do* forecast future shortages and uranium price increases over the next decade or two. These forecasts are tied to predictions of a dramatic shift towards nuclear electric generation around the world. Denison Mines, for instance, in its May 2010 presentation to its stockholders at its General Annual Meeting forecast 54 new nuclear reactors under construction, 148 additional reactors planned, and 342 reactors proposed by governments or energy companies. That would represent a 124 percent increase in the number of nuclear-fuel electric generators in the next decade or so. Denison projects this substantial increase in nuclear generation because of the economic growth taking place, especially in the developing world, and pressure to reduce the use of coal in order to cut greenhouse gas as well as other emissions. It is not clear, however, that the economics of electric generation favor massive investments in nuclear generation. The nuclear option remains the most costly conventional source of electricity. The economic alternative to coal-fired generation in North America and other regions around the world is the use of natural gas in place of coal. Estimates of natural gas reserves have increased dramatically in recent year and the price of natural gas in North American has fallen considerably. Without substantial government subsidies, it is not clear the nuclear alternative for generating electricity would be chosen.

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<sup>76</sup> <http://www.world-nuclear.org/info/inf75.html> accessed November 15, 2010.

<sup>77</sup> **Uranium 2009: Resources, Production and Demand**, a joint report of the OECD Nuclear Energy Agency and the International Atomic Energy Agency. <http://www.nea.fr/press/2010/2010-03.html>

<sup>78</sup> Slide17, [http://www.denisonmines.com/SiteResources/data/MediaArchive/pdfs/investor\\_presentations/agm\\_may\\_6\\_2010\\_web.pdf](http://www.denisonmines.com/SiteResources/data/MediaArchive/pdfs/investor_presentations/agm_may_6_2010_web.pdf).

<sup>79</sup> This “new generation” of nuclear reactors faces serious problems, however. Their fuel cycle increases the opportunity to divert weapons-grade material and aggravate nuclear weapons proliferation problems. In addition, these reactors have faced a variety of technical difficulties that have made their operation unreliable.

In 2009 the US was the source of only 2.8 percent of worldwide uranium oxide production.. Of this small United States contribution, none came from Colorado operations that year. Kazakhstan was the source of about 28 percent of world production, Canada 20 percent, and Australia 16 percent. Namibia, Russia, Niger, and Uzbekistan each were the source of between 5 and 10 percent of total world production.<sup>80</sup> The known recoverable uranium resources estimated in 2009 were distributed somewhat differently than actual production that year. However, even on that basis, the United States had only 4 percent of total known uranium resources while South Africa and Brazil would be added to the list of significant producers, each with about 5 percent of the known uranium resources.<sup>81</sup>

The United States' reasonably assured uranium resources, however, are mostly (about 80 percent) in the more costly range, costing between \$36 and \$59 per pound while almost all of the Australian and most of the Canadian and Kazakhstani resources are available at less than \$36 per pound. Of the countries with significant uranium resources, only Namibia is in a worse cost situation than the United States.<sup>82</sup>

This array of countries, many of which are low cost developing countries, indicate the array of competitors Colorado uranium producers must face and beat on the basis of cost to be competitive. It is important to note that many of these lower cost countries are planning major expansions: Kazakhstan, Saskatchewan (Cigar Lake), Australia (Olympic Dam), among many other planned expansions which collectively are projected to meet reactor demand through 2030.<sup>83</sup>

As mentioned above, Denison Mines Corporation is the owner of the only operating conventional uranium mill in the United States (as of November 2010), the White Mesa mill outside of Blanding, Utah. In its presentation at its Annual General Meeting with stockholders in April 2009, Denison pointed out that its costs of mining and milling uranium surpassed the then spot price of uranium. The spot price was \$44 per pound while Denison's cost of mining and milling in the United States was almost \$66 per pound and its costs in Canada were about \$55.<sup>84</sup> It is important to keep in mind that Denison's White Mesa mill was built 30 years ago. The Sunday uranium mines in San Miguel County, which Denison owns and partially supplies its Blanding mill, date back to the 1950s and have operated under Colorado permit since 1978. Despite having this uranium milling and mining infrastructure already in place, Denison still faces costs in excess of recent uranium prices and ceased both mining and milling convention ore

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<sup>80</sup> Data published by UxCo and presented in Denison Mines' 2010 Annual General Meeting, slide 15, [http://www.denisonmines.com/SiteResources/data/MediaArchive/pdfs/investor\\_presentations/agm\\_may\\_6\\_2010\\_web.pdf](http://www.denisonmines.com/SiteResources/data/MediaArchive/pdfs/investor_presentations/agm_may_6_2010_web.pdf).

<sup>81</sup> World Nuclear Association, <http://www.world-nuclear.org/info/inf75.html>.

<sup>82</sup> Ibid. Based on IAEA estimates.

<sup>83</sup> 2010 Uranium Red Book (Uranium 2009: Resources, Production and Demand—A Joint Report by the OECD Nuclear Energy Agency and the International Atomic Energy Agency)

<sup>84</sup> Slide 22

[http://www.denisonmines.com/SiteResources/data/MediaArchive/pdfs/investor\\_presentations/agm\\_apr\\_30\\_09\\_web.pdf](http://www.denisonmines.com/SiteResources/data/MediaArchive/pdfs/investor_presentations/agm_apr_30_09_web.pdf)



feed stock until March 2010.<sup>85</sup> Energy Fuels, on the other hand, faces the cost of building its proposed Pinon Ridge mill as well as paying for its recent development of the mines intended to supply it. Energy Fuels will need to do this when uranium costs from other sources, such as Denison's Canadian operations, and *in situ* uranium operations in the United States are lower.

Furthermore, extensive uranium supplies also exist in such "secondary" sources as the highly enriched uranium in surplus nuclear warheads, "tails" from uranium enrichment processes, and government and commercial inventories.<sup>86</sup> The World Nuclear Association (WNA) reported that 45 percent of the uranium consumed in the world in 2005 came from such secondary sources. While current policies and laws of the U.S. restrict the volume of uranium that can be released from government stockpiles or "blended" with weapons-grade uranium to make reactor fuel, changes in such government policies could free up substantial quantities of uranium to offset or replace the need for new mining in the US and abroad.<sup>87</sup> In fact, it has been the use of those "politically controlled" secondary sources of uranium that have kept the price of uranium so low that most uranium mines in the United States could not operate during the 1990s. These secondary sources will continue to impact the viability of new uranium mines in the United States for the foreseeable future.<sup>88</sup>

### ***Implications of Uranium Mining Instability for Local Communities***

Uranium mining, like other metal mining, tends to be an unstable industry prone to booms and busts. Colorado's Uravan Mineral Belt knows this well since it has lived through several mining booms and busts and the metal mining industry elsewhere in Colorado and across the West has also had the same experience with other metal mining. The most recent fly up and then decline in uranium prices confirms the volatility of the uranium industry and the impact of that volatility on employment, income, and tax

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<sup>85</sup> Denison has been investing in the White Mesa Mill. It spent \$31 million on mill modernization and improvements in its tailings cells in 2008. Ibid slide 28.

<sup>86</sup> "Military Warheads as a Source of Nuclear Fuel", WNA, October 2009, <http://www.world-nuclear.org/info/inf13.html> ; "Processing of Used Nuclear Fuel," October 2010, <http://www.world-nuclear.org/info/inf69.html> ; <http://www.world-nuclear.org/info/inf75.html>; "Secondary Supplies: Future Friend or Foe," James C. Cornell, World Nuclear Association 2005 Symposium <http://213.198.118.156/sym/authidx.htm> .

<sup>87</sup> Ibid. As with any nuclear technology, including uranium extraction and enrichment, down-blending presents a risk of nuclear proliferation.

<sup>88</sup> The New York Times reported in November 2009 that the United States was negotiating another agreement to continue diluting Russia's highly enriched uranium after the expiration of the current agreement, using some or all of the material from warheads that the nations have agreed to take out of their arsenals. [http://www.nytimes.com/2009/11/10/business/energy-environment/10nukes.html?\\_r=1&hp](http://www.nytimes.com/2009/11/10/business/energy-environment/10nukes.html?_r=1&hp) Even if the new START Treaty is not ratified, the uranium resources in the weapons grade material that could, and in the long run almost certainly will, be converted to reactor fuel serves as an available supply that can easily come into the market.

revenues. The temporarily high prices brought conventional uranium mills back into production in western Colorado and provided conventional feedstock to local uranium mills. Those high prices also spawned Energy Fuels' Piñon Ridge mill proposal. The dramatic drop in price that soon followed also led those mining operations to shut down, newly developed mines not to start up, and one of the mills to cease operations.

Mining industry instability makes the potential employment, payrolls, royalties, and taxes associated with uranium mining uncertain and risky. Colorado's Uravan Mineral Belt will be competing with other areas in the United States, including *in situ* operations, and around the world to expand uranium mining and milling to take advantage of uranium prices the developers hope will go significantly higher and stay high. Given the relatively low quality and high cost associated with the Uravan and other conventional American uranium supplies, it may well be that the Uravan supplies will be uneconomic as countries with larger and lower-cost supplies, such as Australia, Kazakhstan, and Canada bring large increments of supply on line. In addition to the production from existing and new mines, large amounts of uranium from secondary sources could be released to the market if currently restrictive government policies are eased. The rush in the United States and around the world to expand production from existing and new mines as well as secondary sources when uranium prices are high will have the effect of putting downward pressure on uranium prices as supplies increase.

In previous studies of the economies of mining towns and regions, I have found that despite the great wealth that is extracted and the relatively high wages paid to workers, mining rarely makes mining towns prosperous places, primarily because of the economic instability associated with mining.<sup>89</sup> In addition, the labor needs of mining operations are continually declining as new labor-saving technologies are deployed. Miners and their families, businesses that serve them, and governments that provide infrastructure and services do not know how long the jobs and payroll will last. As a result, everyone is cautious about making investments in homes, businesses, and public infrastructure because they do not know when the next big layoff will come. It should not be surprising, then, that mining, milling, and smelter towns tend to have higher unemployment rates, lower average incomes, and slower rates of growth in jobs and aggregate real income. Mining, in general, does not support sustained local economic vitality. That is the "economic anomaly" of mining.<sup>90</sup>

This too represents a significant social cost that has to be weighed against the economic benefits of mining. When communities become specialized in metal mining, they go through severe cycles of economic expansion followed by economic collapse that severely stresses families and tends to tear the social fabric of communities as

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<sup>89</sup> ***Lost Landscapes and Failed Economies: The Search for a Value of Place***, Island Press, Washington DC, 1995.

<sup>90</sup> See the author's "The Economic Anomaly of Mining—Great Wealth, High Wages, Declining Communities," in Chapter 3 of ***Mining in New Mexico: The Environment, Water, Economics, and Sustainable Development***, L.Greer Price, et al., editors. New Mexico Bureau of Geology and Mineral Resources, New Mexico Institute of Mining and Technology, 2005. Also the author's ***Lost Landscapes and Failed Economies: The Search for a Value of Place***, 1996, Island Press, Washington, DC.

workers have to commute out to work or they and their families have to move away.<sup>91</sup> The ongoing decline in labor demand can strand substantial local government infrastructure as well as private commercial infrastructure as the population declines. Mining communities come to be dominated by abandoned businesses and buildings and take on a run-down appearance. The massive damage to the surrounding landscape associated with extracting very low grade ores and disposing of the waste also discourages the in-migration of people and businesses not associated with mining. The result is ongoing local economic decline despite the high wages paid to miners and the huge amounts of wealth extracted.<sup>92</sup>

To the extent that Colorado's Uravan Mineral Belt counties join the rush to rebuild a uranium industry infrastructure, it may well ride the economically and socially disruptive uranium roller coaster once again with similar results. Such mineral industry roller coaster rides do not bring sustained economic vitality.

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<sup>91</sup>For a recent review of this literature see William R. Freudenburg and Lisa J. Wilson, 2002. "Mining the Data: Analyzing the Economic Implications of Mining for Nonmetropolitan Regions," *Sociological Inquiry*, 72(4):549-75. See, also, Richard S. Krannich and A.E. Luloff, 1992, "Problems of Resource Dependency in U.S. Rural Communities," *Progress in Rural Policy and Planning* 1:5-18; Nancy L. Peluso, Craig R. Humphrey, and Louise P. Fortmann, 1994, "The Rock, the Beach, and the Tidal Pool: People and Poverty in Natural Resource-Dependent Areas," *Society and Natural Resources* 7(1):23-38; Lisa J. Wilson, 2001, *Riding the Resource Roller Coaster: A Comparison of Socioeconomic Well-Being in Two Midwestern Metal-Mining Communities*, Ph.D. dissertation, Department of Sociology, University of Wisconsin, Madison, WI.

<sup>92</sup>Power, T. P. Chapters 4 and 5 of *Lost Landscapes and Failed Economies: The Search for a Value of Place*, Island Press, Washington, D.C., 1996.

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